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THE PENGUINS OF SOUTH GEORGIA

BY

ROBERT CUSHMAN MURPHY

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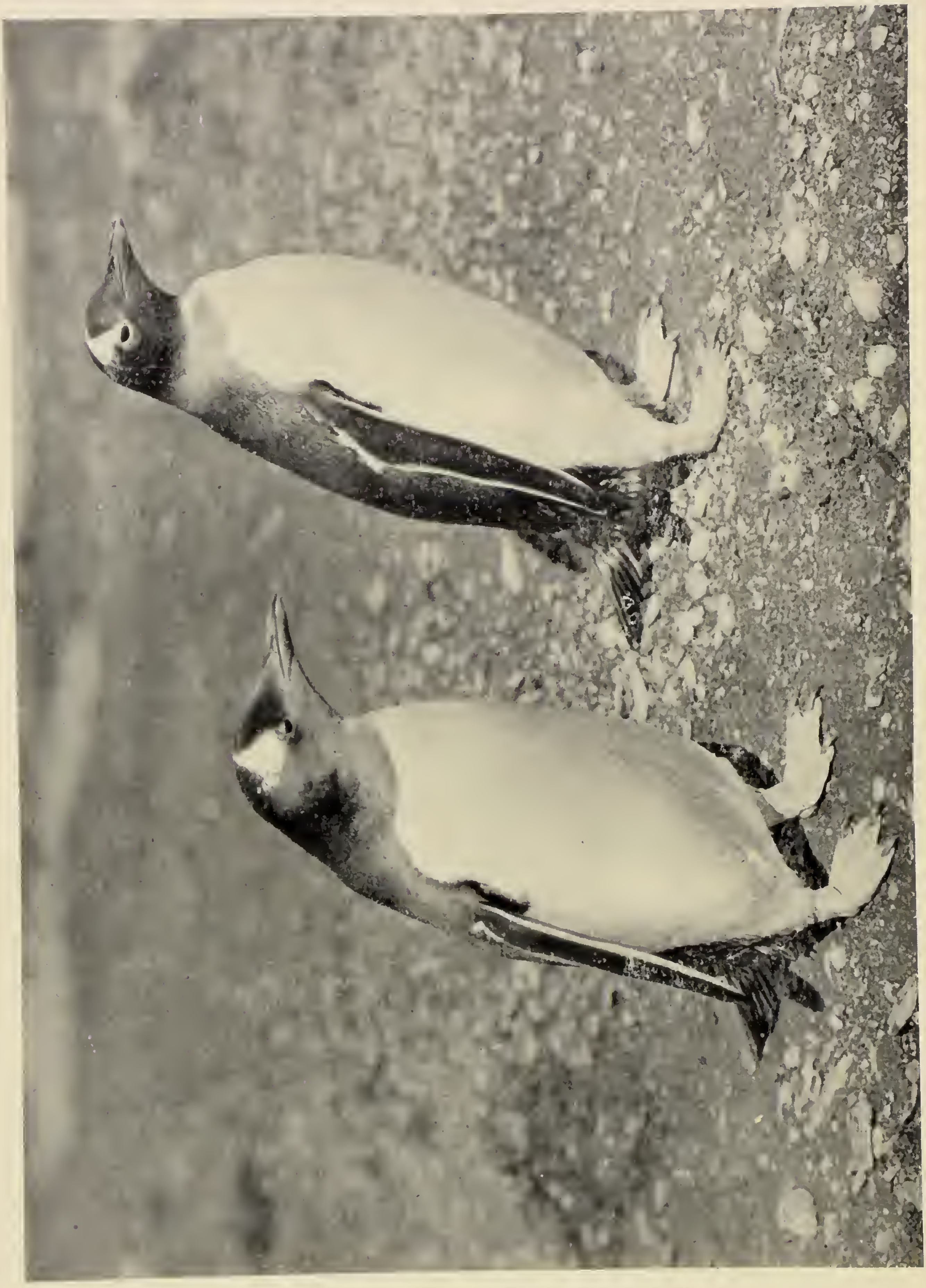

Pygoscelis papua, Bay of Isles, Dec. 23, 1912.

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Five, possibly six, species of penguins have been recorded from South Georgia, and at least four of these were at one time established residents. The macaroni penguin (*Eudyptes chrysolophus*) and the ringed penguin (*Pygoscelis antarctica*) are now rare. Representatives of the former genus belong typically to a more northerly area* while *Pygoscelis antarctica* is a polar species. It is not unnatural, considering the diminution in the numbers of penguins which has certainly occurred at South Georgia, that the truly *Subantarctic* types should have outlived competitors whose ranges had stretched, on the one hand, southward from a more temperate life zone, and, on the other, northward from an Antarctic sea. To-day the dominant species at South Georgia is *Pygoscelis papua*, while the splendid king penguin (*Aptenodytes patachonica*), likewise native to the Subantarctic, occupies numerically the place of a poor second.

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* *Eudyptes chrysolophus* has, however, been recorded from the South Orkneys, where it may possibly even breed. *Cf.* Clarke, *l. c.*, pp. 231-233.

My field work at South Georgia extended from November, 1912, until March, 1913, thus including the greater part of the penguins' breeding season.* Conditions, however, were not favorable for a sustained and exhaustive study of these fascinating birds. Working entirely alone, with a multiplicity of interests; living for the most part on board the sealing brig *Daisy*, which was anchored miles distant from the penguin rookeries; stormbound for days at a time without hope of being able to get ashore — I should have had enough to contend against without the added factor of human interference. But the ignorance and destructiveness of the *Daisy's* crew were the greatest of all hindrances to successful work. Unrestrained, the sailors and officers periodically raided the penguin settlements, killed large numbers of the adults not only for food, but for the skins as well, and destroyed many more of the eggs than they could either eat or take back to the United States as marketable "curiosities." The most deplorable incident was the wholesale theft of eggs from two colonies of king penguins at the Bay of Isles. Many of these contained large embryos, and such eggs as could be neither eaten nor blown were thrown overboard. As a result of this piece of vandalism, I was denied the privilege of seeing any young king penguins during our entire visit. Moreover, the pitiable remnant of this fine species was doubtless seriously set back in its waning struggle to keep a foothold at South Georgia.

Under such limitations the following observations were made. They are scattered notes, jotted down in the field; linked together they form at best a fragmentary record of the life histories of the king penguin and *Pygoscelis papua*.

Aptenodytes patachonica Forster

Aptenodytes patagonica Cat. B. Brit. Mus., XXVI, p. 627.

The king penguin was formerly an abundant bird at South Georgia, but it is now obviously in danger of extinction. Captain James Cook, the discoverer, found large numbers of the species on the occasions of his several landings in January, 1775, and James Weddell, visiting South Georgia in 1823, wrote the following quaint account, which, in the light of recent discovery, has become classic:

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* See "A Report on the South Georgia Expedition," *Science Bulletin of the Brooklyn Institute Museum*, Vol. II, No. 4, 1914, pp. 43-101.

> Of the bird tribe, the king penguin is the most worthy of notice. The penguins are of a very gregarious nature. They go in large flocks along the shore, erect, and with a waddling gait. When seen through a hazy atmosphere, they may be not inaptly mistaken for a body of men.
>
> In pride, these birds are perhaps not surpassed even by the peacock, to which in beauty of plumage they are indeed very little inferior,—as may be seen in our principal museums. During the time of moulting, they seem to repel each other with disgust, on account of the ragged state of their coats; but as they arrive at the maximum of splendor they re-assemble, and no one who has not completed his plumage is allowed to enter the community. Their frequently looking down their front and sides in order to contemplate the perfection of their exterior brilliancy, and to remove any speck which might sully it, is truly amusing to an observer.
>
> About the beginning of January they pair, and lay their eggs. During the time of hatching, the male is remarkably assiduous, so that when the hen has occasion to go off to feed and wash, the egg is transported to him, which is done by placing their toes together and rolling it from the one to the other, using their beaks to place it properly. As they have no nest, it is to be remarked, that the egg is carried between the tail and legs, where the female, in particular, has a cavity for the purpose.
>
> The hen keeps charge of her young nearly a twelvemonth, during which time they change and complete their plumage; and in teaching them to swim, the mother has frequently to use some artifice; for when the young one refuses to take the water, she entices it to the side of a rock, and cunningly pushes it in, and this is repeated until it takes the sea of its own accord.

The present great reduction in the numbers of the king penguin has been caused undoubtedly by human depredations, in part by the foraging raids of sealers and whalers, but perhaps in an even larger measure by traders in penguin oil. Regarding this last class, Klutschak, who visited South Georgia on an American sealing schooner in 1877, wrote:

> Human greed has been the cause of great persecution of these creatures. I am told (although personally I cannot vouch for it) that oil made from penguin fat was formerly utilized in tanning leather, and that vessels came for the purpose of taking these birds in huge numbers in order to extract the oil. This commodity, which must always have been expensive, has now been superseded by cheaper and perhaps better chemical preparations, hence the destruction of the penguins has ceased. Proof that they were slaughtered in former times, however, may be seen along the whole northern and northeastern coasts where the small iron try-pots, always arranged in pairs, still lie about. At French Harbor* parts of a French penguin-hunting ship, which was wrecked in this labyrinth of reefs, may still be seen. (Translation).

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* A cove lying west of Cape Buller, not designated on recent charts.

Since South Georgia has been made a political dependency of the Falklands, the resident birds have come under the protection of law, but perhaps too late for the king penguins because of the impracticability of enforcing legal restraint along hundreds of miles of isolated, uninhabited coast.*

We discovered three king penguin colonies, all in the neighborhood of *Pygoscelis* rookeries, but all on low ground. The smallest colony, comprising only a dozen birds, was on the west shore of Possession Bay; the two others on the south shore of the Bay of Isles, five kilometers apart, with the barrier of Grace Glacier between. The eastern and larger of these was situated 1500 meters south of the bay among a barren waste of morainic stones. A great bank of unmelting névé bounded the settlement on the west, while a violent glacial torrent separated it from the sloping edge of Lucas Glacier on the east. In such a gulch, between walls of snow and ice, swept by southerly gales that descended through a rift in the mountains, a band of about three hundred and fifty king penguins made their home. Four years earlier, according to members of the *Daisy's* crew, the same settlement had contained a far greater number of birds during the breeding season.

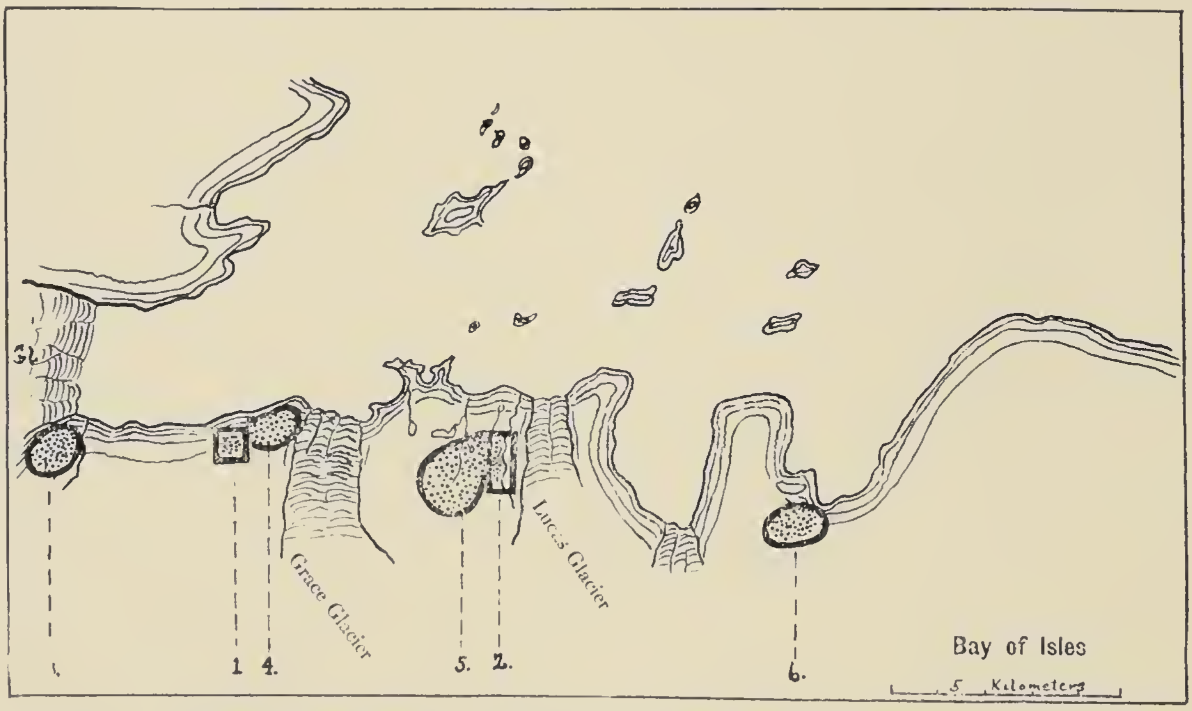

Fig. 1. Penguin colonies at the Bay of Isles, South Georgia Nos. 1 and 2, *Aptenodytes patachonica*. Nos. 3, 4, 5, and 6, *Pygoscelis papua*.

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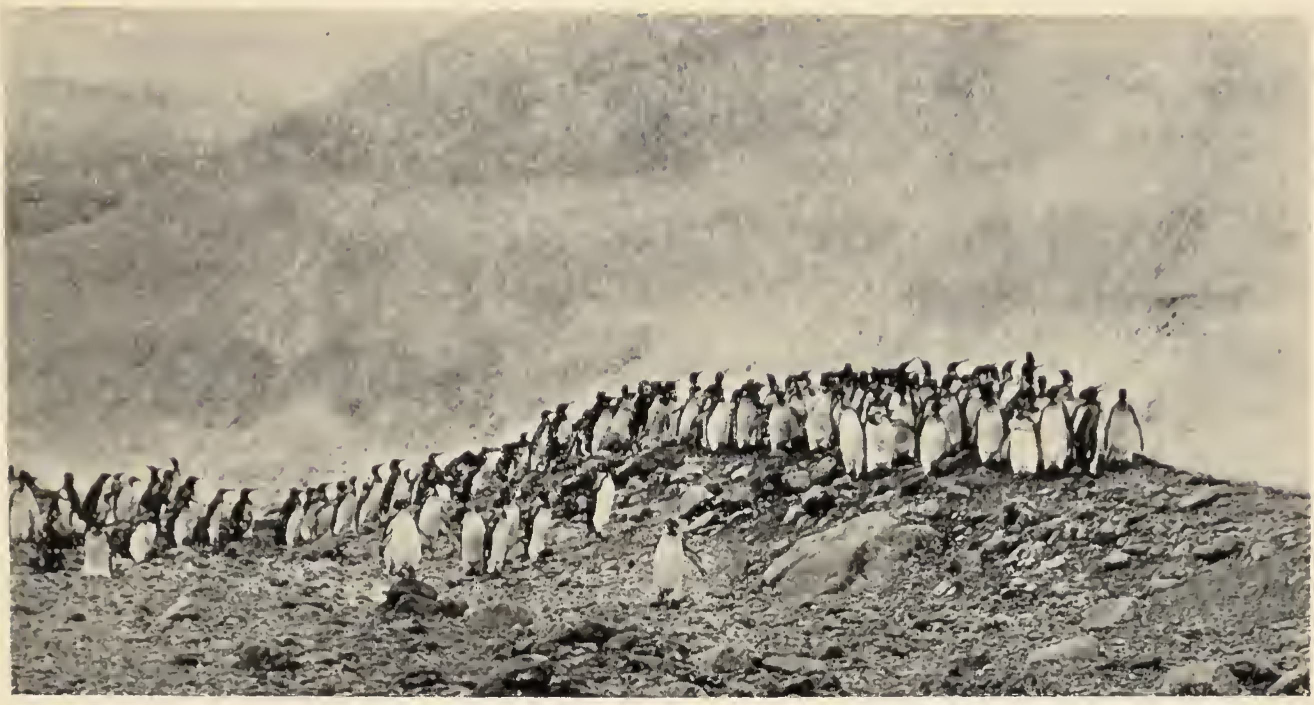
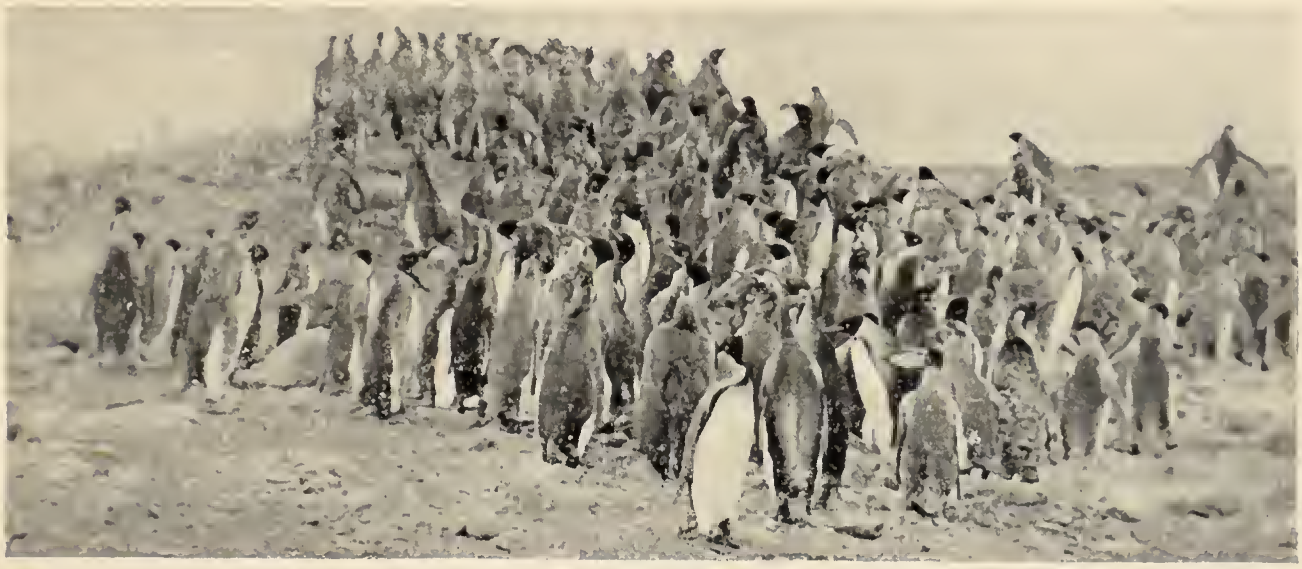
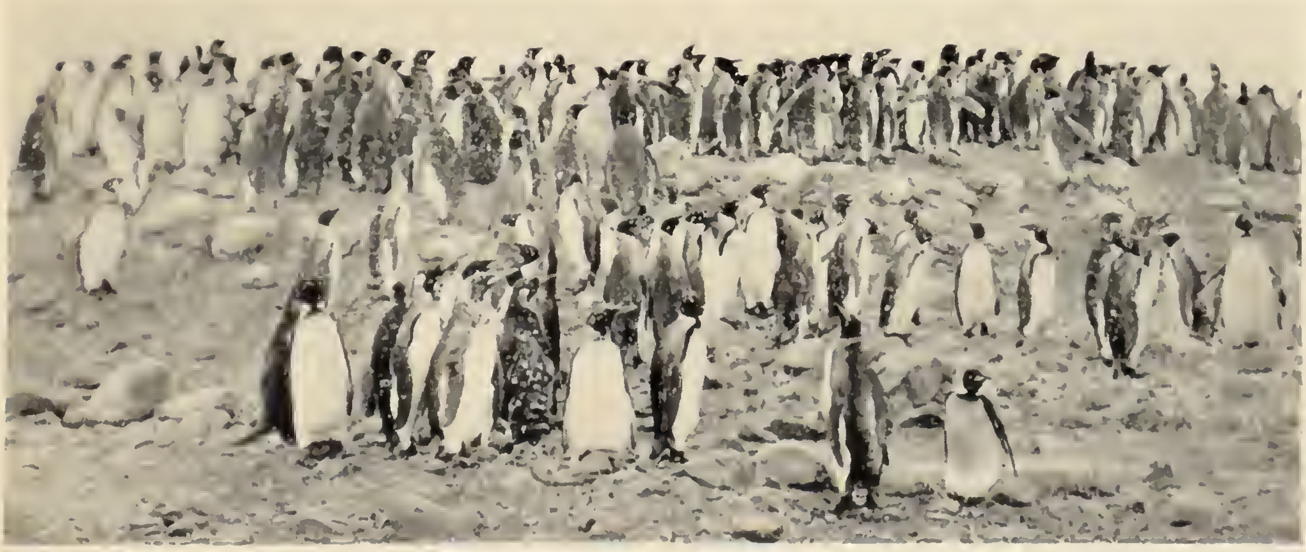
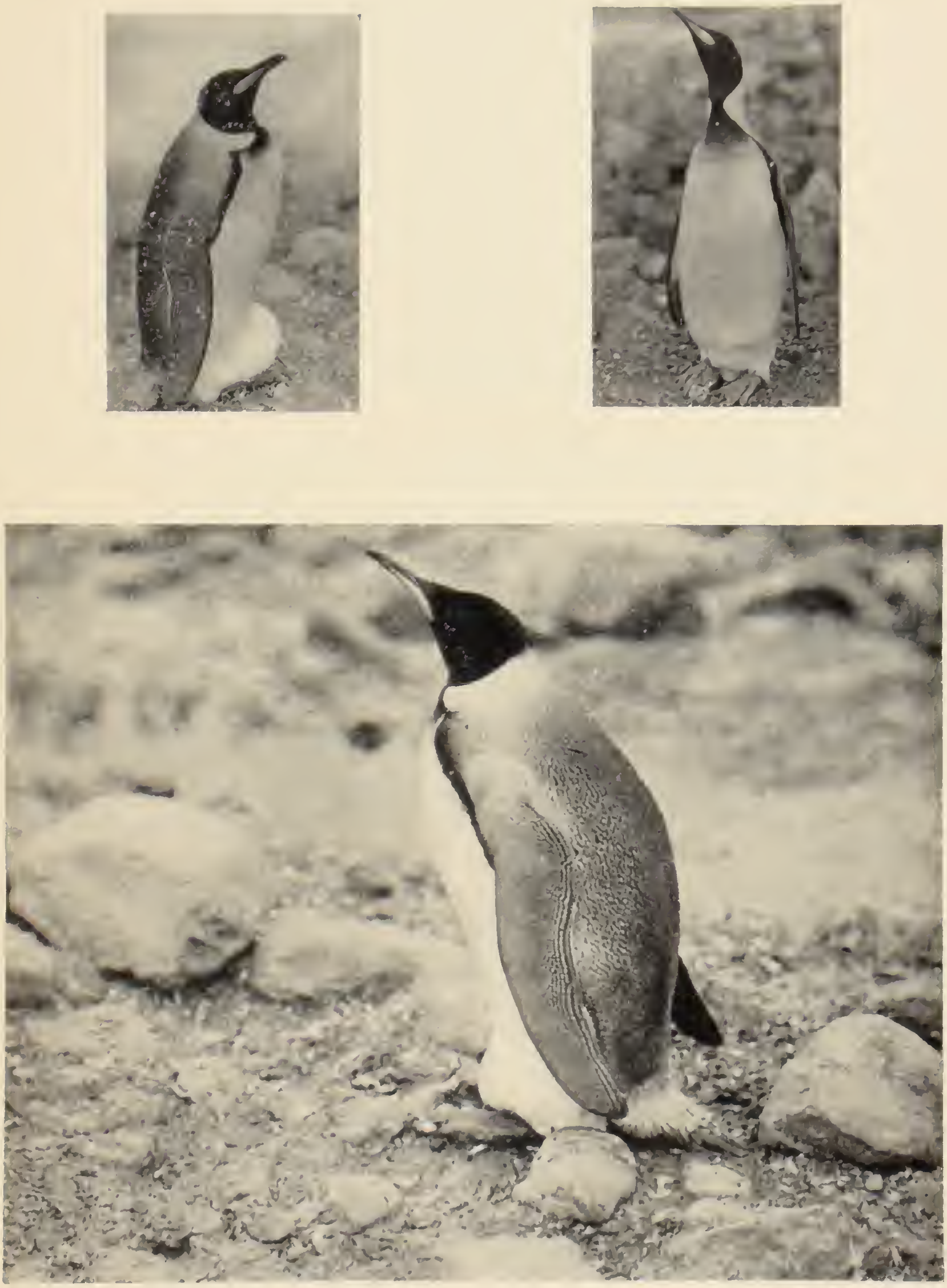
* A penguin oil industry is still conducted at Macquarie Island, south of New Zealand, but apparently without disastrous results owing to the limited numbers of birds which are annually killed.



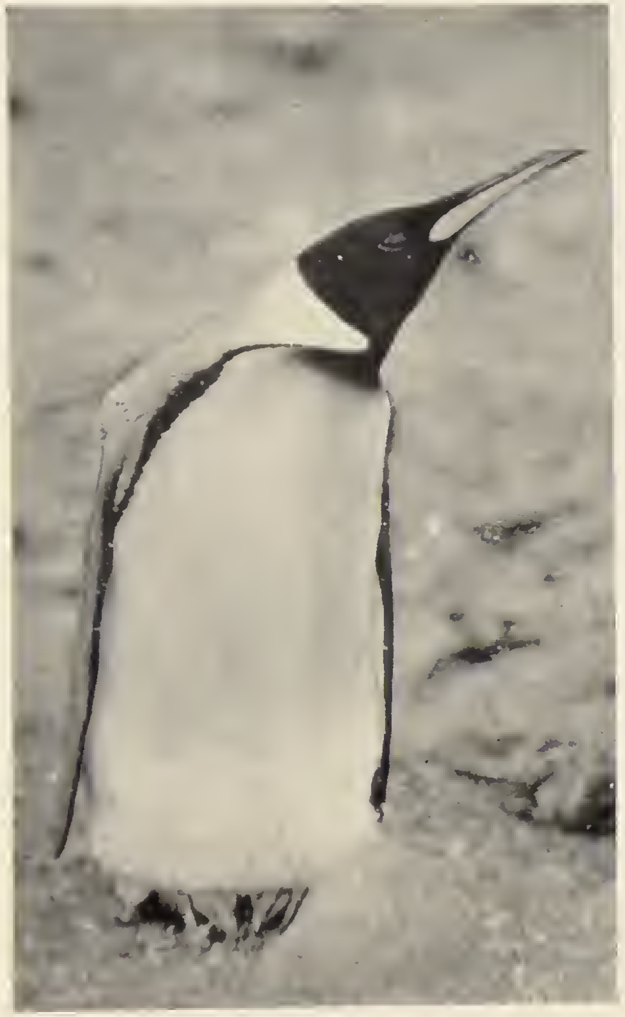


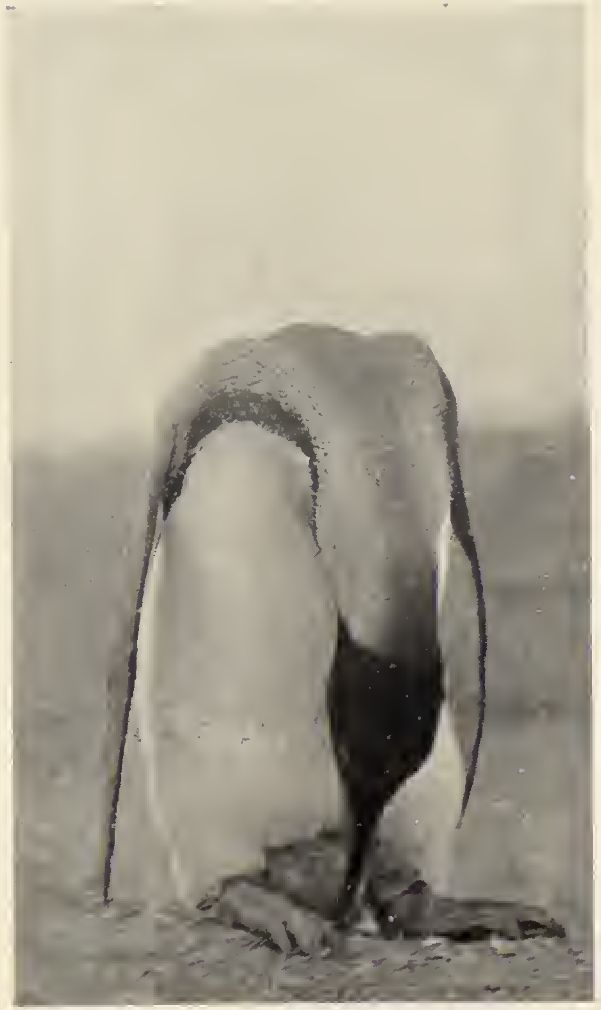


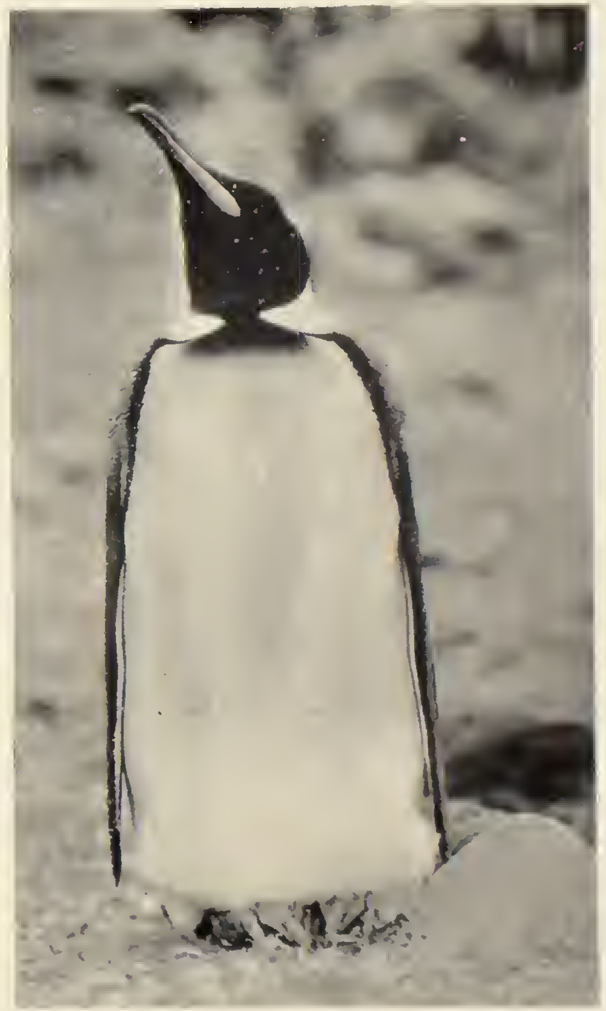
1, 2, 3. Three views of the Lucas Glacier colony of king penguins, Dec. 24, 1912. The background is a high bank of névé. The two lower pictures show the free birds massing and beginning to march toward the sea, leaving yearlings, molting adults, and sitters, huddled together in the rear.



1, 2, 3. Incubating king penguins. The upper right hand picture shows a bird which had just been robbed of its egg.







1 and 3. Two views of the same incubating bird. Bay of Isles, Dec. 24, 1912. 2. King penguin tucking away its egg. Feb. 4, 1913.

In this paper I shall refer to the king penguin communities of our acquaintance as the Possession Bay colony, the Grace Glacier colony, and the Lucas Glacier colony, respectively. I failed to find a trace of the colony in Antarctic Bay which is recorded by Lönnberg, and which is known to have existed as late as the year 1905.

With the exception of a single king penguin that came out on the beach of King Edward Cove, Cumberland Bay, on November 26, 1912, no example of the species was seen far from the rookeries.

On December 16 many of the kings at the Grace Glacier colony, (No. 1, of fig. 1), which lay on a slight rise behind the beach, were incubating eggs, while at the same time half a dozen young of the previous year, fully grown but with ragged patches of long down still attached to their contour feathers, were associating with free adult birds.* The sitters stretched up to as great a height as possible at the approach of their first human visitors (at least during that season), and clung tenaciously to their eggs. After the members of our crew had gathered many eggs and had put them in one spot on the ground, the robbed penguins approached the pile and slyly appropriated eggs to replace the lost ones. But not only did they attempt to take one egg—the proper complement—several tried to tuck *two* between their thighs. One bird pathetically attempted to gather up an egg which had been crushed flat when a sailor, tipping its owner forward, had seized it too roughly.

In common with the emperor penguin (*A. forsteri*) the king penguin develops insatiable "sitting" propensities. Repeatedly I saw robbed kings mothering smooth stones in place of eggs, and those which did not have recourse to such cold solace shuffled around on the full extent of the foot for a while after losing their egg, instead of rising at once to the ordinary digitigrade gait. It takes them some hours to become accustomed to an empty egg repository. The egg, as Weddell correctly infers, is carried in the space between belly, tail, and feet. I was never able, however, to discover in either sex anything resembling a "cavity" such as Weddell mentions. The position of the sitting king penguin is satisfactorily described by the accompanying photographs—squatty, with inturned toes, depressed tail, and a broad transverse fold of skin covering the front of the egg which is raised above the ground and rests upon the bird's metatarsi.

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* I was not able, either at this time or later, to confirm Weddell's observation that molting king penguins are repelled by the others, although both molters and sitters are given to congregating principally with their own kind.

Incubating king penguins can shift about slowly, in spite of the eggs on their insteps. They drag themselves along rather painfully, maintaining their hunched positions, and hitching their feet with short steps so that the egg may not roll out. They are fond of crowding together closely, yet seemingly for no better purpose than to facilitate quarreling! Day after day at the Lucas Glacier colony I was a neutral witness to their noisy squabbles. The sitters glare at each other, with sinuous necks twisted and heads cocked sidewise, and deal resounding whacks with their flippers, or lunges with their sharp bills, to all their neighbors. Often whole groups will be engaged in an indiscriminate skirmish with these rapiers and broadswords. The birds are careful to maintain their equilibrium while banging each other, but it is a wonder, nevertheless, that no harm comes to the eggs. On February 5 I photographed a typical battle. One sitter was employing its bill to mutilate the back of another's neck. The latter bird, grunting vehemently, was delivering backhand blows with one wing but without turning to face its opponent. Only the intrusion of weapons of other pugnacious penguins succeeded in diverting the attentions of these two from one another. The affair ended in a general mêlée in which nine birds took part, each for itself and against every other. Such is the reach and flexibility of the king's extensible neck that each sitter can very easily become the center of a large circle of trouble. And yet they *like* to sit as near together as possible, and if they move, it is only to draw to still closer quarters!

According to an officer of a sealing vessel at South Georgia, the mated king penguins relieve each other in the duties of incubation with more frequency than the nesting *Pygoscelis* penguins. I was informed that a bird which has been marked with a cord round the leg was observed to alternate with its mate during the forenoon of each day. The period of incubation is said to be seven weeks.*

King penguins of the Lucas Glacier colony which had been robbed of their eggs not later than December 22, had begun to lay a second time by January 8. On January 16 three females brought to the ship by sailors had within their oviducts eggs almost ready for laying, while a fourth bird had been killed in the very act of depositing its egg. On January 27 I skinned several which contained well-formed yolks not yet detached from the ovaries. Weddell names the beginning of January as the time of mating and laying. We, however, found eggs in an advanced state of incubation in mid-December, while, on the other hand,

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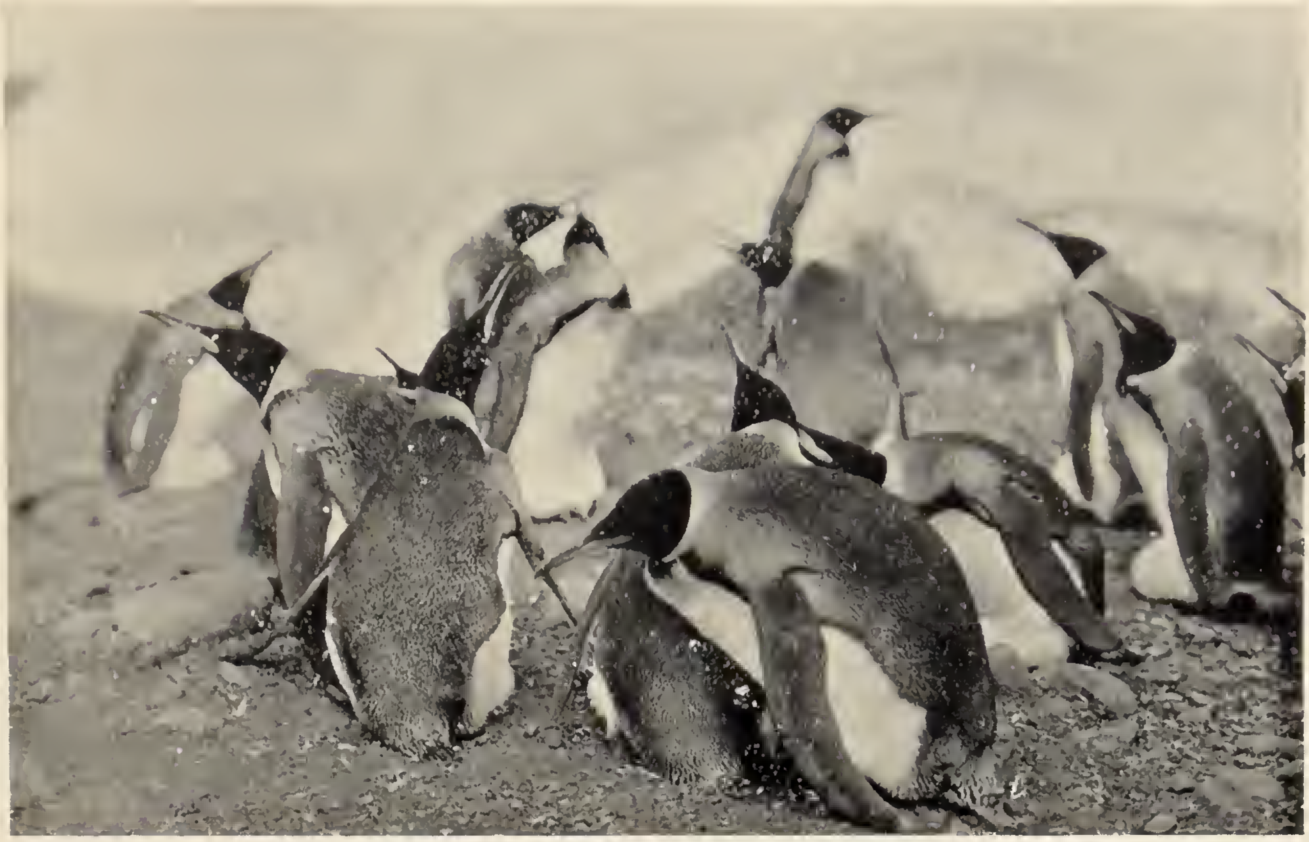
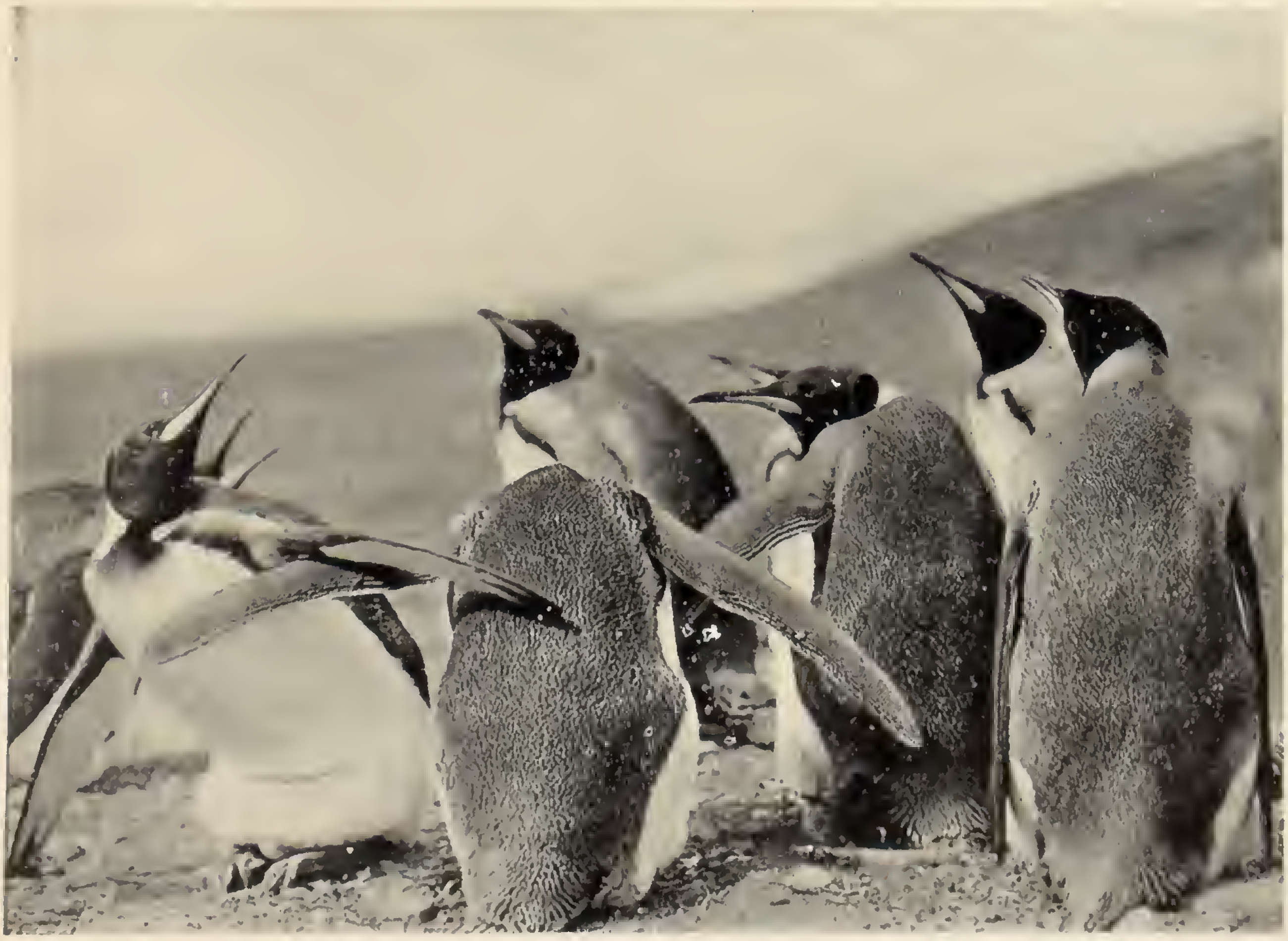
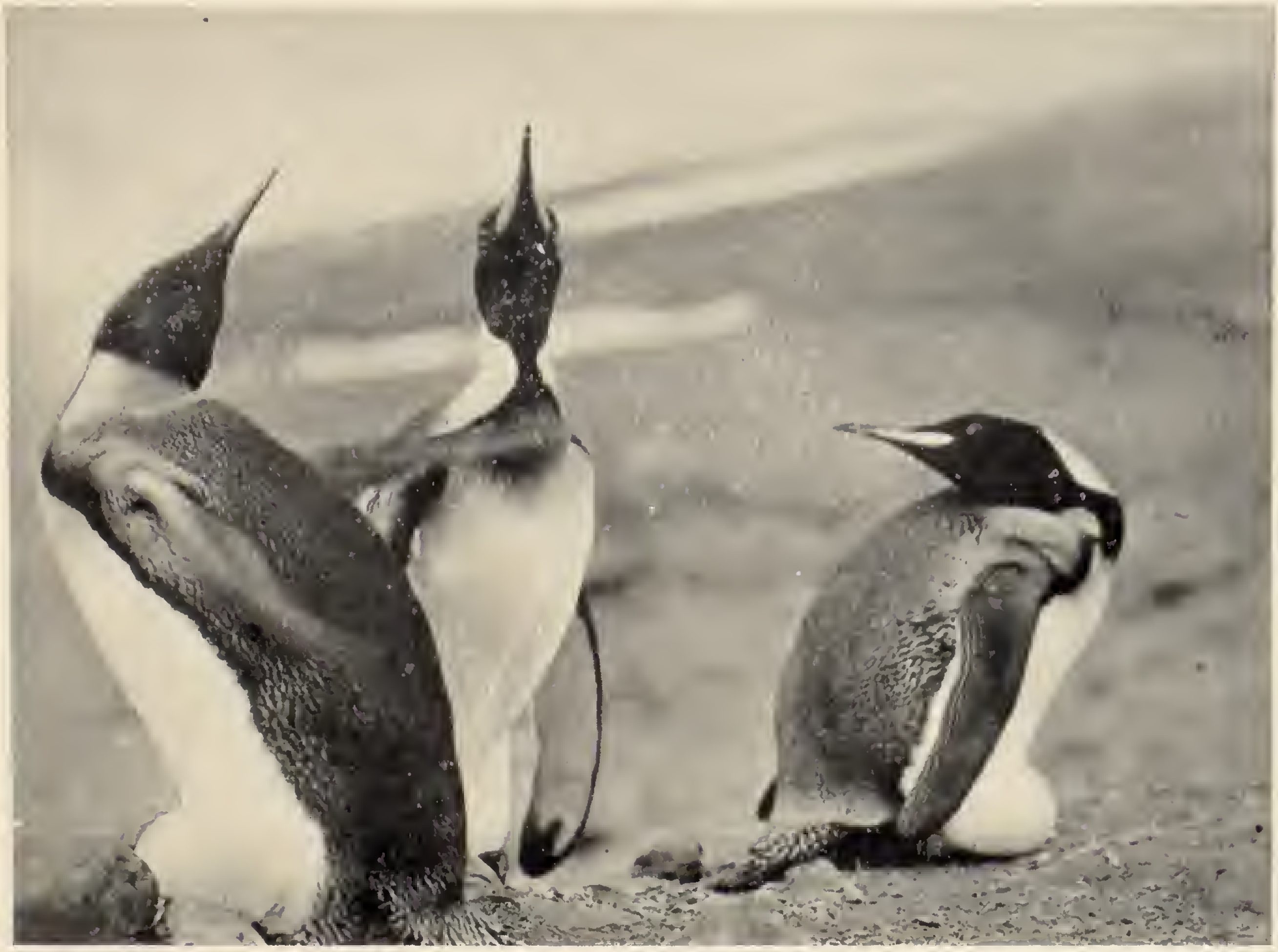
* *Cf.* Moseley, *l. c.*, p. 154.



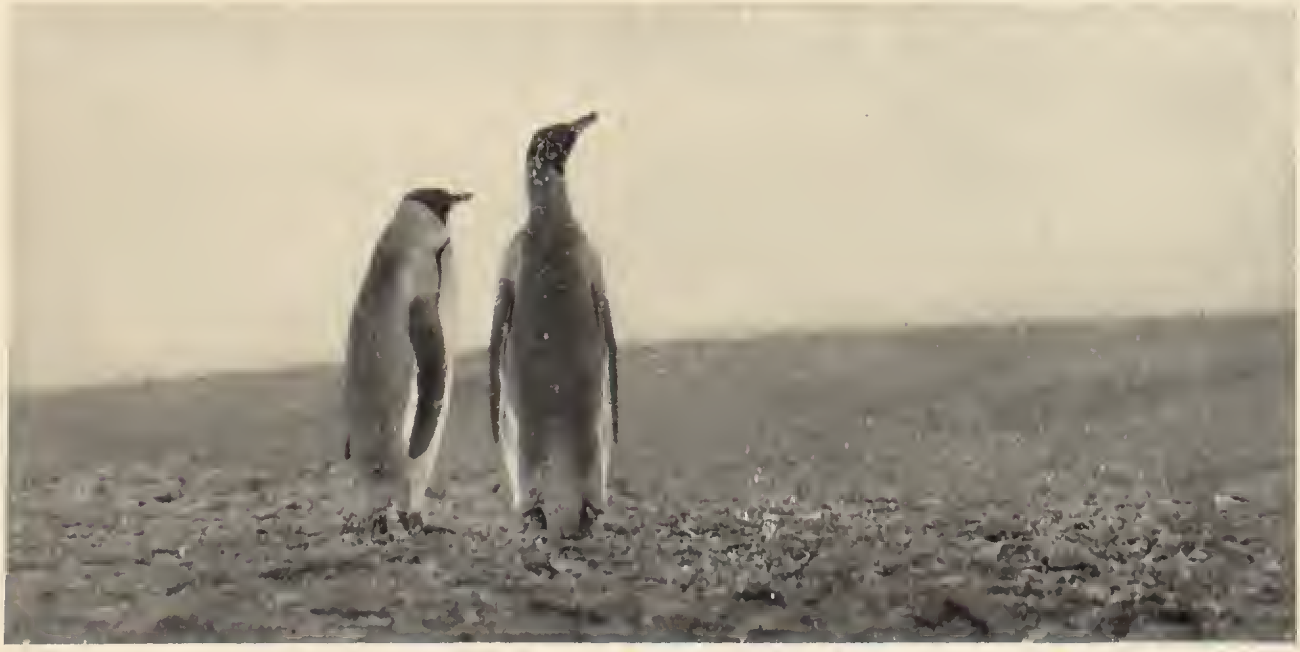
1. Group of sitters at the Lucas Glacier colony, Feb. 4, 1913.



2. Birds of the same group quarreling, and striking with their wings. The pointed end of the egg shows between the toes of the bird at the left.



A battle in progress. The camera failed to stop sharply the rapid flippers of the bird in the foreground. The bird on the right is watching, ready to use its bill when opportunity offers. All three penguins are covering eggs.



2. Courting pair, Feb. 4, 1913. The picture illustrates a king penguin's ability to "telescope" its neck.

freshly laid eggs have been collected at South Georgia as late as March 10. It seems probable, as has been suggested by Lönnberg, that the breeding season extends through the major part of the southern summer, with great individual variation in the time of laying. I saw a few birds still engaged in pairing about the end of January. Courting couples stroll apart from the main flocks, and seem fond of standing side by side on high places such as knolls overlooking the sea. Caresses are then exchanged, the usual form being for the birds to cross their necks, swaying from side to side, and then for the cock to press slowly downward on his mate's nape until her head is bent quite to the ground.

For the reason given in the introduction I have no data regarding the appearance or life history of the king penguin during the natal down stage. Three chicks in juvenal down* several months of age, labelled "Bay of Isles, June 4, 1914", have been sent me from South Georgia. The smallest of these is 50 cm. in length. Its bill, to which the egg-tooth still adheres, measures only 49 mm. from the gape. The other two youngsters are each about 66 cm. long, with bills of 63 and 64 mm., well-developed rectrices, and much longer down (about 35 mm. max.) than the smaller bird possesses. The down in all three specimens is of a nearly uniform dusky or smoky drab color all over the body. In the case of the youngest bird it is very thin and short over a masklike area on the face. Traces of light-colored natal down still cling to the tips of the dark feathers on the occiput.

Yearling specimens of my own collecting show that the juvenal down grows to a length of 90 mm. or more, fading greatly and turning a streaky golden brown or yellowish with age.† It always remains shortest on the head, becoming hairlike and matted elsewhere on the body before the postjuvenal molt.

This yearling change of coat is well illustrated by five specimens which represent as many stages of the molt. The down on the flippers is the first to go; it is then lost from the belly, next from the back, and lastly from the upper breast, throat, and head. Fragments of it cling longest on the nape of the neck. For the most part the whole coat comes off in the form of tangled mats which resemble wool or hair. The sprouting plumage fails for a few days thoroughly to cover the skin of the head and gular region which is hidden only gradually by a dense growth of black feathers. The new feathers of the upper breast reveal a pale yellowish tinge. The auricular patches are yellow, slightly brighter than the breast, but with no suggestion of the brilliant orange hue of the mature plumage. The characteristic, subtle, greenish-yellow gloss or "bloom," however, makes its appearance on the crown of the head soon after the down has entirely disappeared. The young king penguin is then a less glorified replica of its parents, with a weaker, wholly blackish bill.*

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* Terminology of Dwight, *Annals N. Y. Acad. Sci.* Vol. XIII, 1900, p. 106.

† Von den Steinen mentions blonde examples seen by him.

We observed molting adult king penguins throughout our stay at South Georgia, so that the season of this function, like that of laying, would appear to permit of great individual latitude. Discarding the old plumage seems to resemble the same process among the *Pygoscelis* penguins, described elsewhere in this paper. Following the molt of the king penguin's feathers, the horny, orange shields on the mandible flake off, exposing fresh surfaces beneath. On the basis of a single observation I venture the assertion that these birds first shed their mandibular shields at the end of their second summer, possibly just before they migrate to sea. At any rate I saw on February 25, 1913, at Possession Bay, a yearling which had cast the black lateral plates of its rami, the newly exposed surfaces being pure white.

Apparent vanity and aloofness are two marked traits of the king penguins. They dwell within a stone's throw of *Pygoscelis* penguins, play in the same glacial streams and ponds as the latter, and follow the same vocation of deep-sea fishers, yet the society of the two species is almost inviolably distinct. In only one instance did I find a king penguin associating with its smaller relatives. This was on February 28, near the Possession Bay colony, when one king was seen trotting along shore in company with a flock of johnnies (*P. papua*). The sight was so unusal that experienced sealers from the *Daisy's* crew had never seen the like. They laughed at the lone king, and inferred that it must have been a pariah among its kind. King penguins commonly deport themselves in an amusingly lofty manner toward human beings, paying slight attention to a man's quiet intrusion into their midst. If they are annoyed, they march away, slowly and with an air of indifference, until they have been actually frightened by abuse, when they fall upon their breasts and scurry on all fours. I have seen a fox terrier put a whole band of kings to

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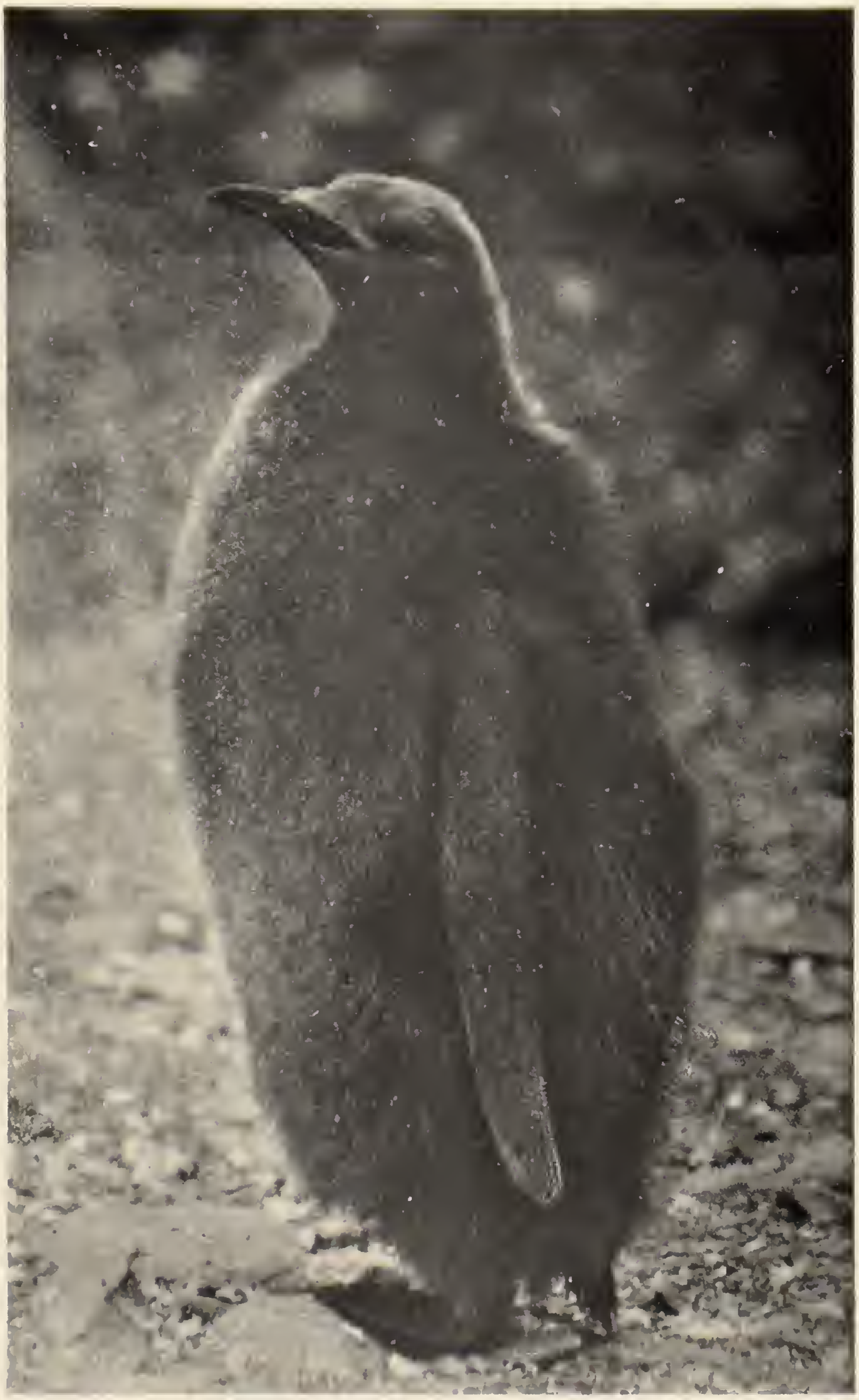
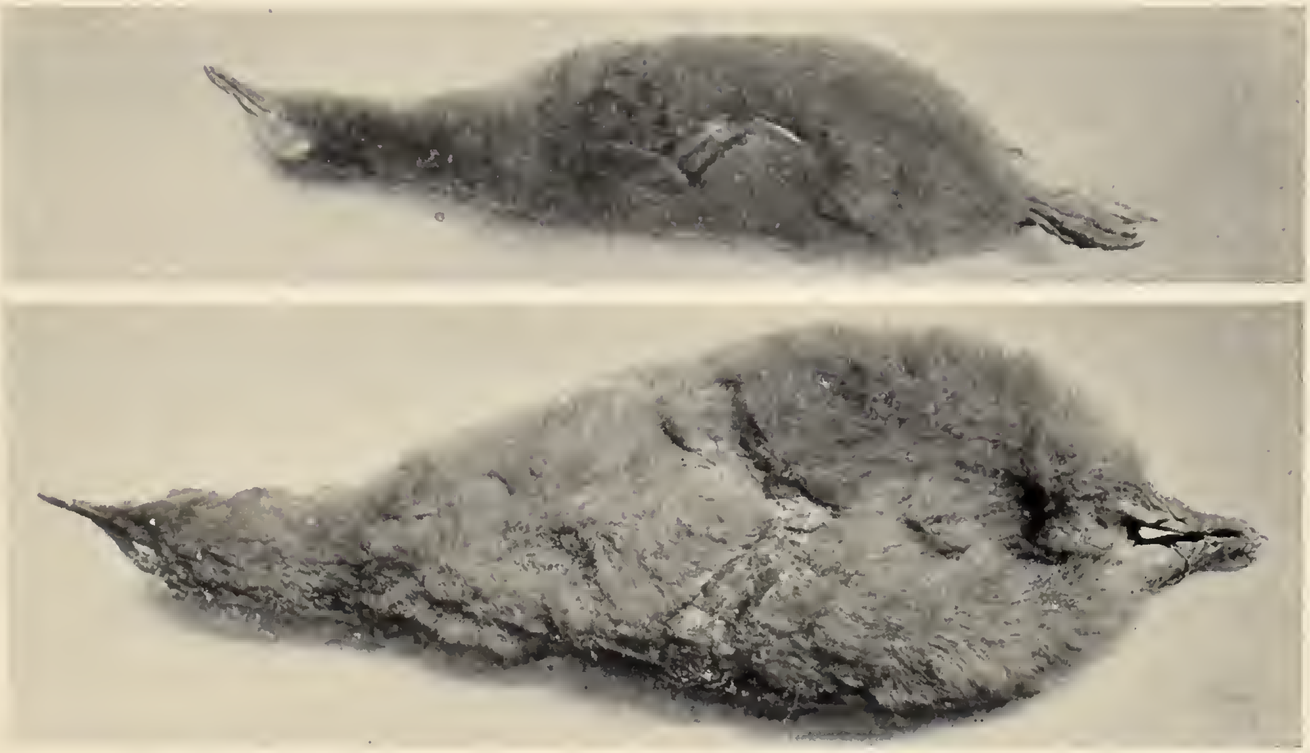
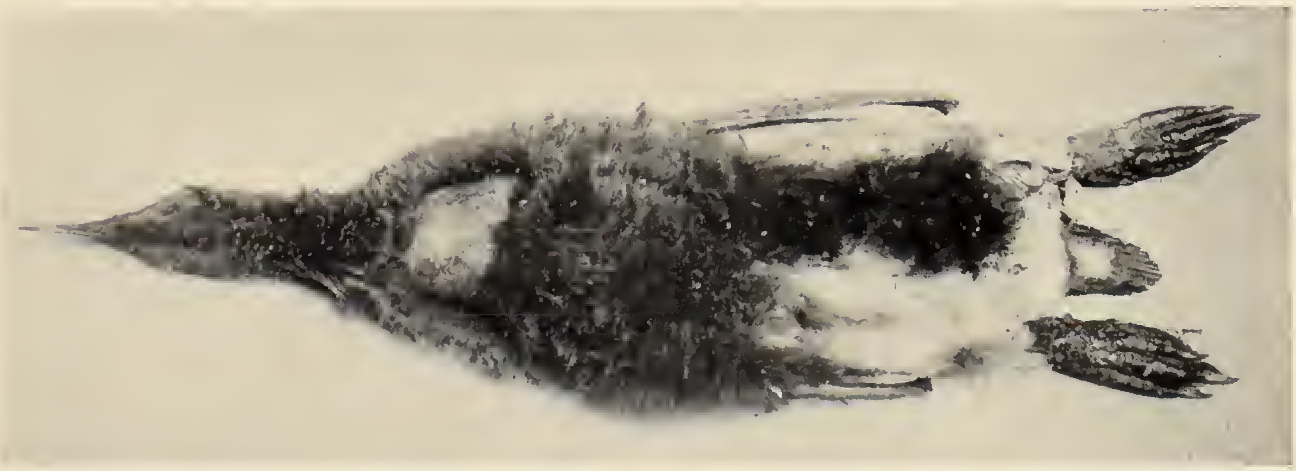
* Judging from our knowledge of the growth of the emperor penguin (*A. forsteri*), the king penguin should be about eight months old at the completion of the molt.



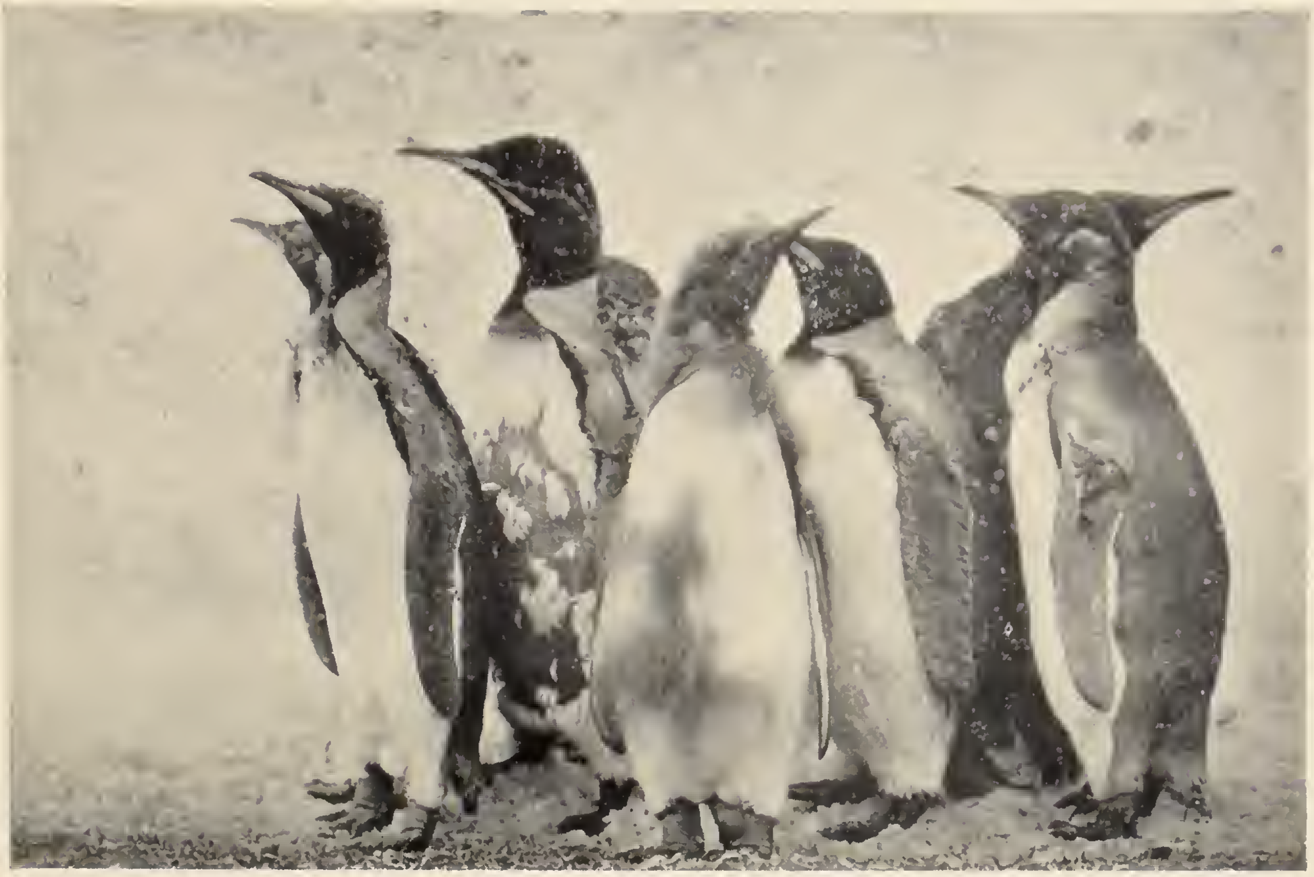
Yearling king penguin of the Lucas Glacier colony, Dec. 24, 1912.



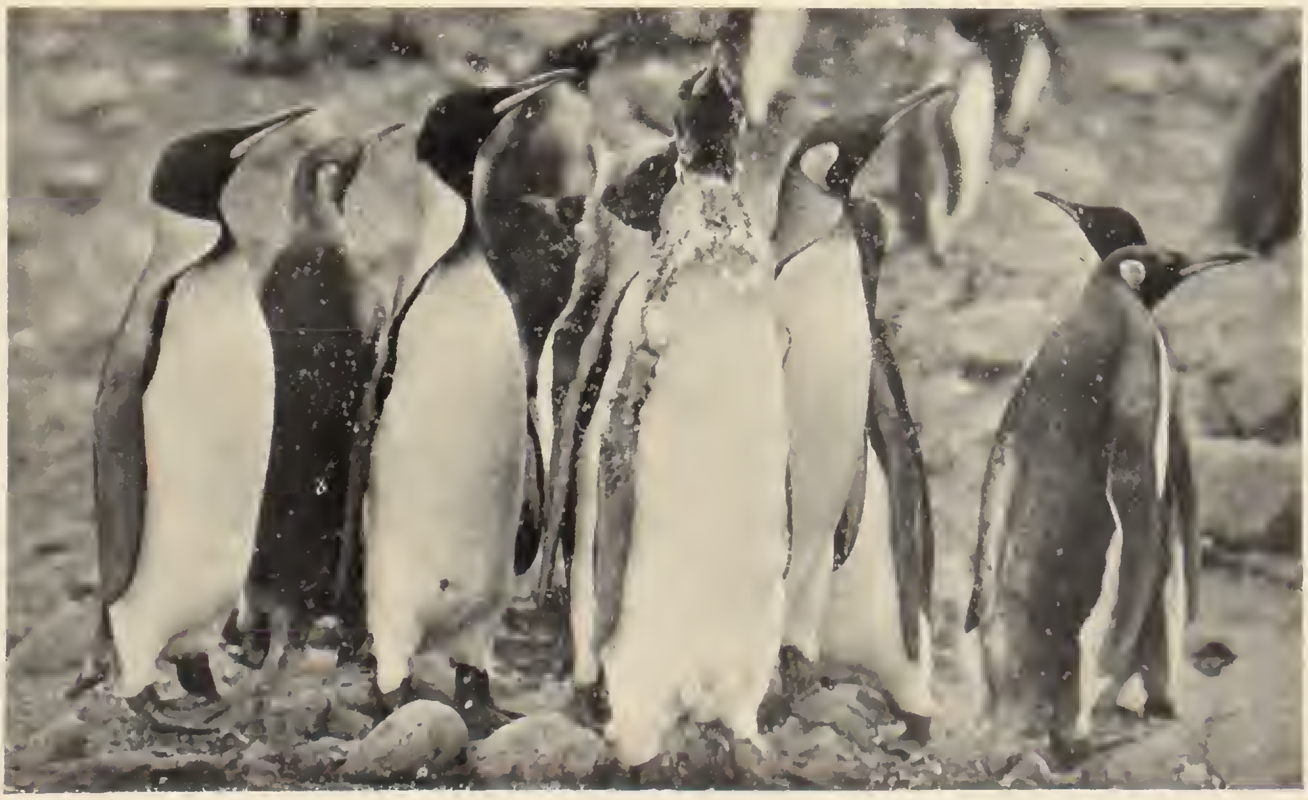
1. Two young king penguins collected at the Bay of Isles, June 4, 1914, (mid-winter).



2. Yearling male in the molt. Bay of Isles, Dec. 24, 1912. The plumage feathers are fairly well-grown on belly and back, but are hardly through the skin on the bare breast spot.



1. Molting king penguins, Dec. 24, 1912. The central figure is a yearling losing its down. The others are adults in various stages of the annual molt. Cast-off feathers strew the snowbank in the background.



2. Stages of the molt. At the extreme right is a fluffy bird in worn plumage, just beginning to lose its feathers. The central bird has nearly completed the process, while the two sleek birds at the left are in new clothes. Bay of Isles, Dec. 24, 1912.

ignominious flight. Sitting birds alone are stolid and fearless, refusing to be stampeded even after their eggs have been taken.

Between the Grace Glacier colony and the sea there was a snowbank about twenty meters broad, down which I saw king penguins coasting, otterlike, during December and January.

The voice of an adult king penguin is a martial sound, a long-drawn bugle call, highly musical and almost worthy of being known as a tune. When delivering the call, the bird stretches grandly to its full height, points its bill skyward, and the long volley rings forth from an expanded chest. At the close of the effort the head is tilted forward with a jerk and the bugler stands at attention—a rigid, constrained pose always held for several moments. The yearling penguin's call is a clear whistle of three notes, as soft and sweet as the whistle of an oscine bird.

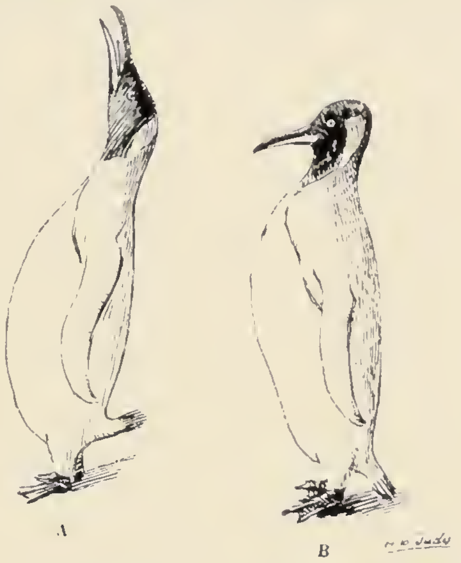


Fig. 2. *a.* King penguin trumpeting. *b.* Posing after trumpeting.

The actions of "bachelor troops," *i. e.* birds of both sexes which are neither molting nor incubating, always furnish entertainment to an observer. Such bands frequently come out of the sea during the warmer parts of the day to sun themselves on the beaches. The birds sleep either prone or upright; if in the latter position, often with the bill turned behind the wing, where ages ago the ancestors of penguins may have had warm coverts. They preen themselves scrupulously and even perform the difficult stunt of balancing on one foot while they scratch their heads with the other. Their "regimental" characteristics, such as standing at attention, marking time, and marching in single file or in doubles, are very striking. They frequently shake their wings rapidly while they walk or stand. Contrary to a statement repeatedly affirmed of penguins in general, the king penguin's wing is not a mere flipper, immobile except from the shoulder; on the other hand, it is capable of considerable flexure at both joints, and can readily be doubled into a z-shape, a fact which several of my photographs demonstrate.

Cuttlefish beaks were the only edible substances found within the king penguins' stomachs. All of the birds collected were very fat, the layer under the skin sometimes being two centimeters thick.

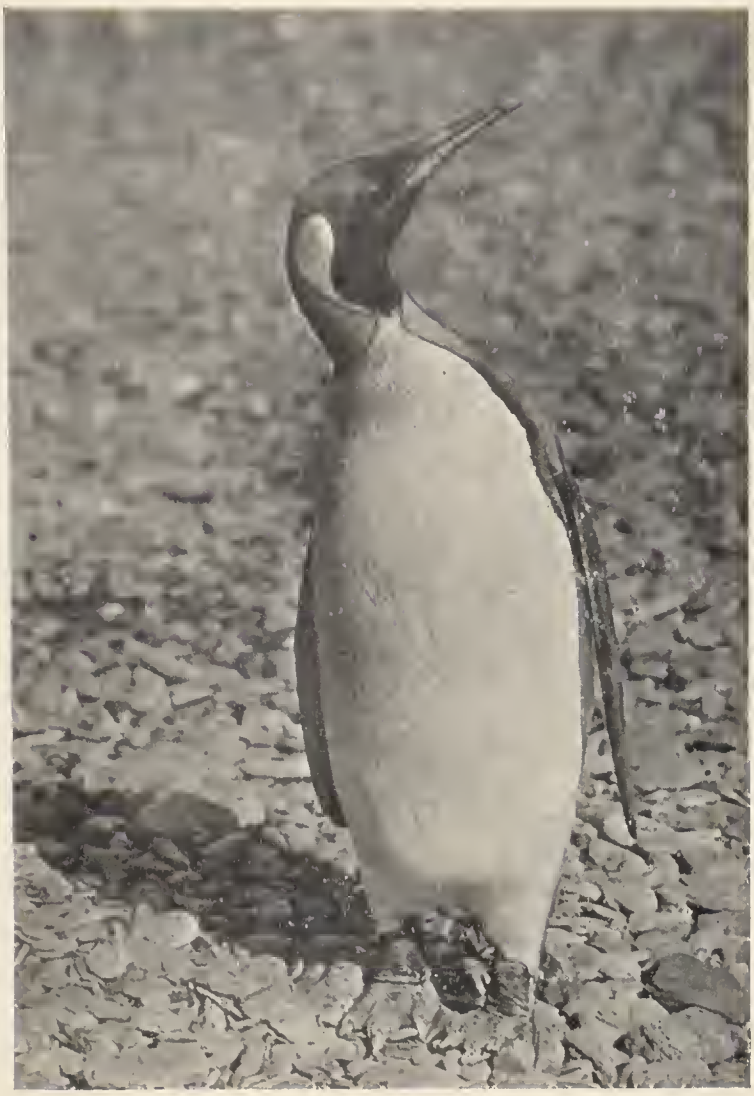
As regards enemies, I judge that this species is little troubled by the skua (*Catharacta*), the scourge of the *Pygoscelis* rookeries. Its enemy in the ocean is the sea leopard (*Hydrurga leptonyx*). From the stomach of one of these seals killed at the Bay of Isles, early in the morning of January 14, 1913, I took the remains of four king penguins, besides fish and other material. The magnitude of this breakfast may be more fully appreciated if I record that the weight of mature king penguins from the Lucas Glacier colony averaged 20 kilograms.

Measurements in millimeters of 20 king penguins collected at South Georgia, are as follows:

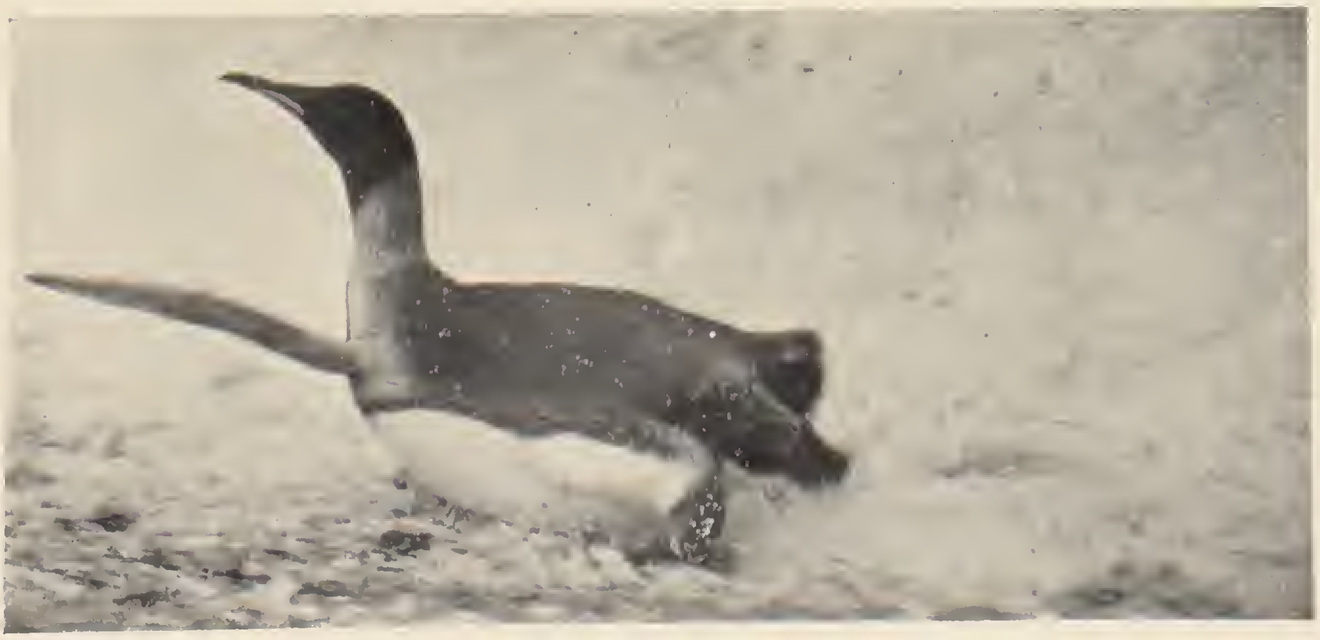
Adults	Sex	Date 1912-13	Bill from gape	Bill from nasal feathers	Wing from axilla	Tail	Foot, heel to tip of middle claw
R. C. M. 1583	♂	Dec. 24	124	69	336	51	175
1585	♂ breeding	Dec. 24	132	75	335	52	175
1757	♂ breeding	Jan. 26	131	75	323	72	174
1758	♂ breeding	Jan. 26	136	75	326	68	180
1760	♂ breeding	Jan. 26	123	73	339	63	173
1818	♂	Jan. 26	131	78	341	72	180
1801	♂	Feb. 1	127	74	325	51	179
1579	♀	Dec. 24	130	76	320	78	157
1580	♀	Dec. 24	125	76	320	55	172
1584	♀	Dec. 24	119	69	332	53	168
1759	♀ breeding	Jan. 26	130	77	330	79	171
1761	♀ breeding	Jan. 26	127	77	324	70	162
1762	♀ breeding	Jan. 26	125	74	320	76	172
1816	♀	Jan. 26	122	71	326	45	166
1817	♀	Jan. 26	125	69	325	61	172
Yearlings							
1576	♂	Dec. 24	110	33		59	179
1577	♀	"	110	35		66	161
1578	♀	"	112	30		71	171
1581	♀	"	108	31		83	162
1582	♂	"	115	34		70	165

The length of an adult in the flesh, from tip of bill to tip of tail, was 97 centimeters; to tip of longest toe, with legs outstretched, 114 cm.

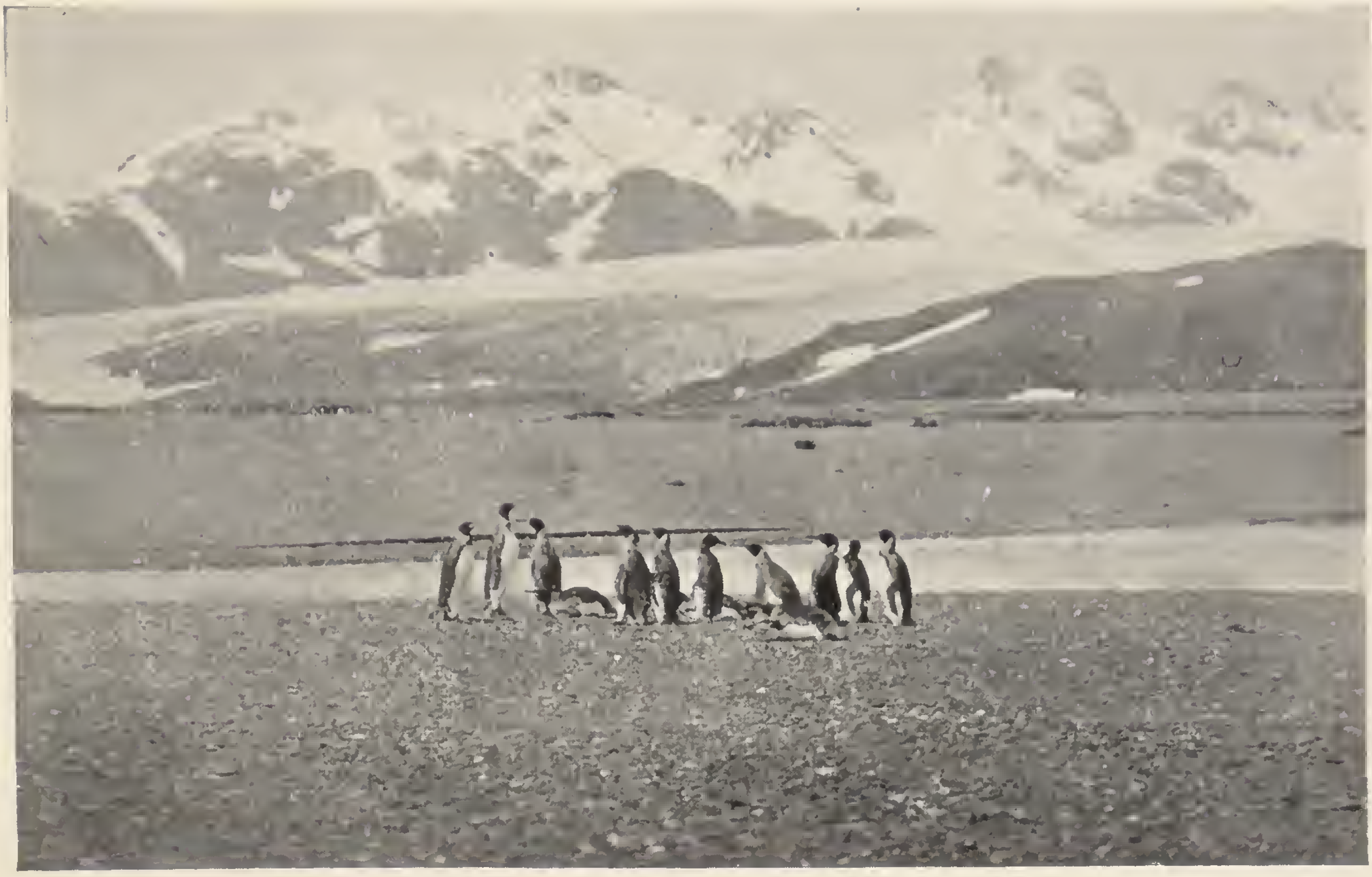
The sides of the mandible are yellow, deepening into orange and then into coral-red toward the center of the mandibular shield. Reported



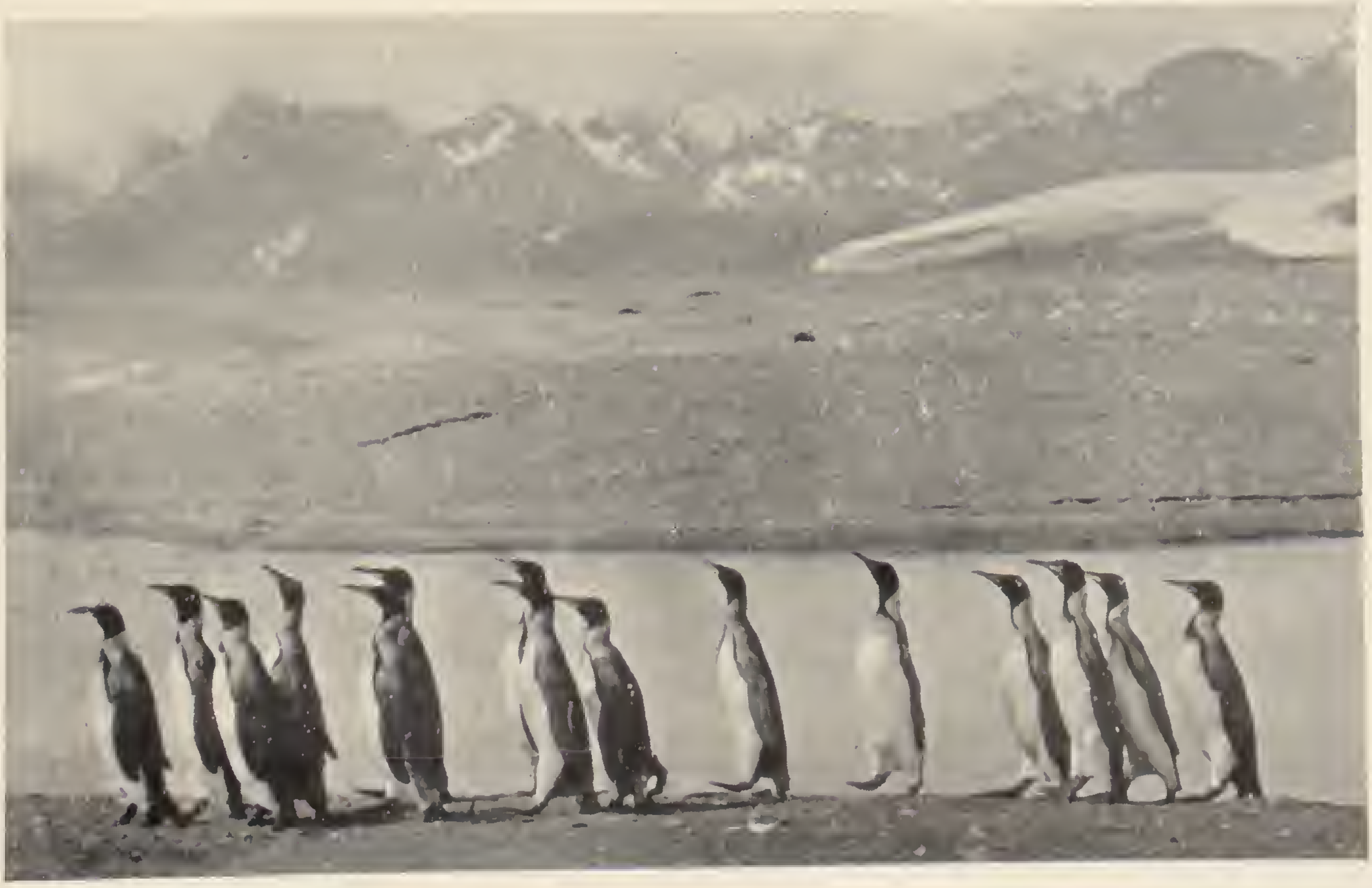
1. Adult king penguin, showing the auricular patch, which is indistinct in most of the photographs owing to lack of orthochromatic quality in the plates used. Cumberland Bay, Nov. 30, 1912.



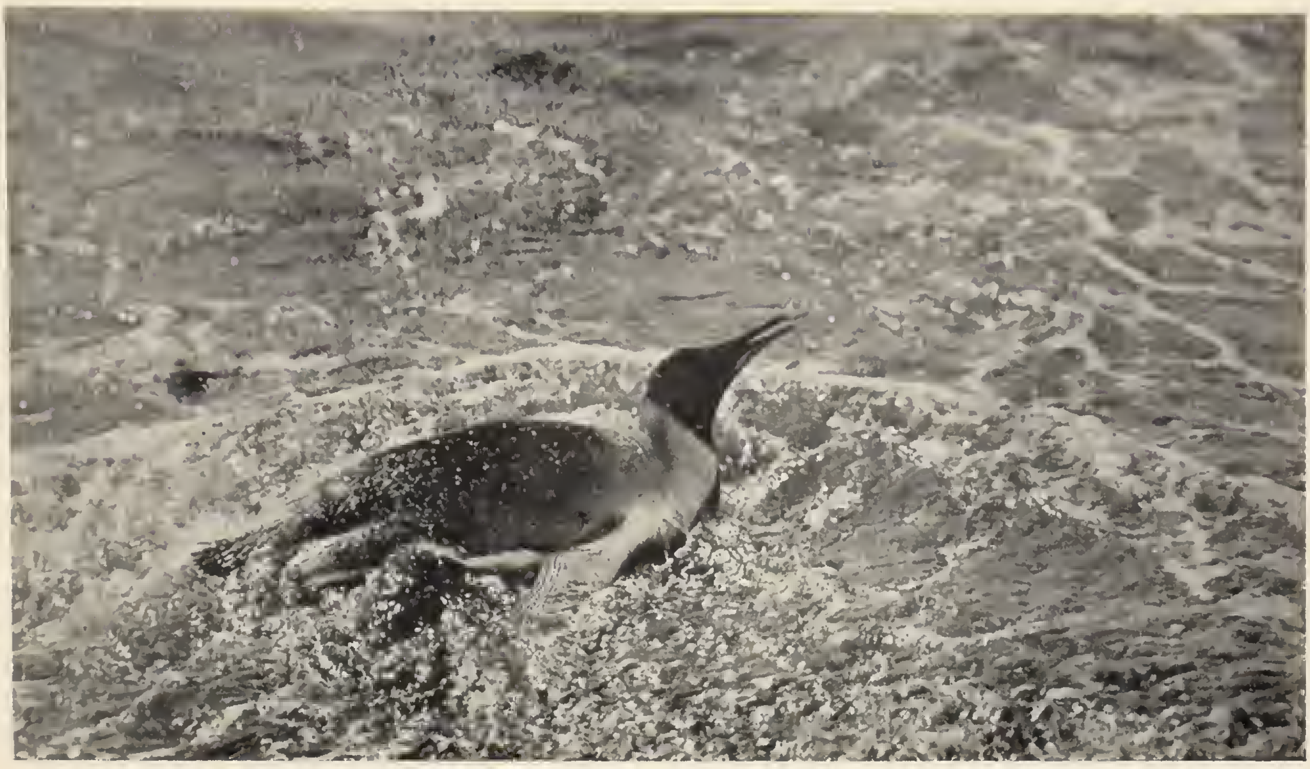
2. A frightened bird "tobogganing."



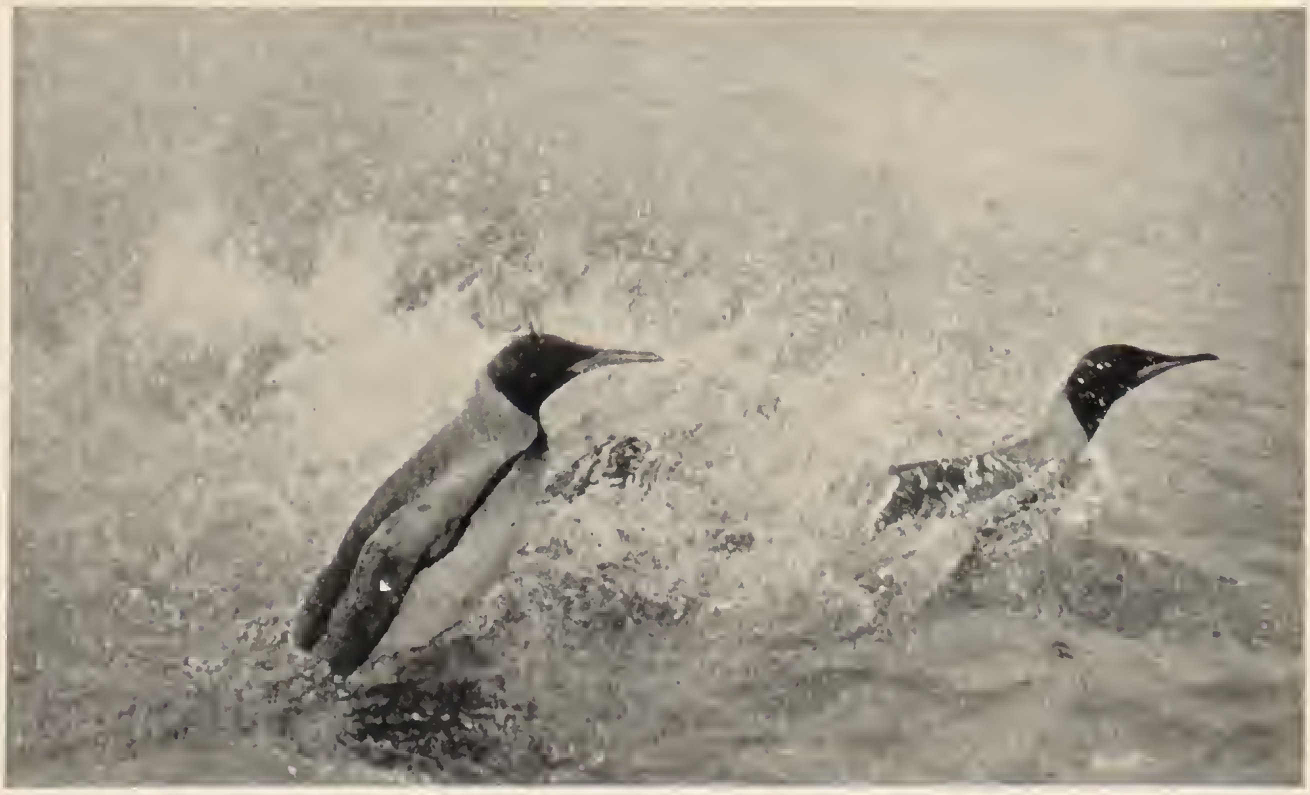
1. "Bachelor" kings aroused from a noon-day nap, Bay of Isles, Feb. 16, 1913. Lucas Glacier in the background.



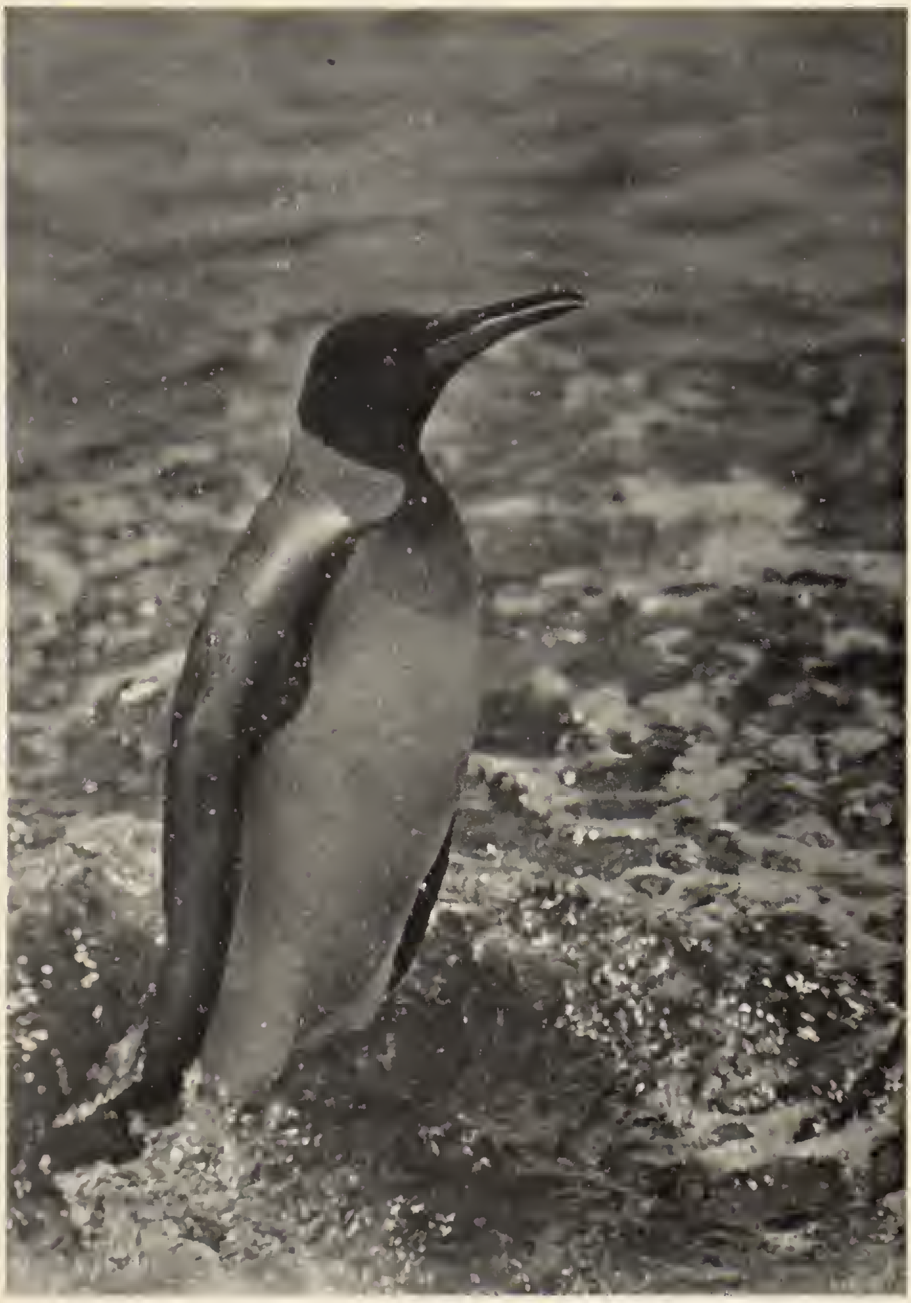
2. The same band marching toward the bay.



1. King penguin entering the Bay of Isles.



2. Taking to the water. Three birds show in the photograph, the one in the background being in the act of plunging below the surface.



Coming ashore after long submergence. Bay of Isles, Feb. 16, 1913. The limits of the orange area on the breast show distinctly in this photograph.

sexual difference in the color of the shield is not borne out by my observations, nor by my specimens, in which the bills of mature females are quite as richly colored as those of males. In one adult male, No. 1801, Feb. 1, 1913, the shields are flaking off.

The color of the reticulated iris is raw umber. The pupil is *square* when contracted; when dilated it takes a polygonal shape, like an "iris" diaphragm of a photographic lens. In life, the prominent nictitating membrane is frequently drawn over the eye.

The auricular-patches of mature birds are cadmium yellow; at the front of the neck, where the branches are confluent, the color becomes orange. The posterior edge of the patch, where it joins the bluish tone of the hind neck, is distinctly green, the blending of the yellow and blue producing a solid color on the individual feathers. The concealed portions of the yellow feathers of the ear-patches are white; those of the feathers on back and breast, grayish. The feather-shafts are characteristically flattened and curved, with a width as great as 2 mm. Because of their external convexity they exert a spring-force against the body and function as shingles over the downy aftershafts. The feathers are placed equidistant from one another, forming regular, transverse and diagonal rows over the whole skin. One, or more often two, filoplumes spring from about the base of each feather. The aftershafts are single, but in the form of complex tufts. They are attached at the base of the inner surface of the flattened quills, by which they are matted snugly against the body.

The large eggs of the king penguin are subpyriform, and of a pale olive-green color. An egg taken from the oviduct of a dead bird is pure white. Soon after being deposited, however, the eggs become so plastered with mud that the original color of the shell is indistinguishable. Measurements in millimeters of six specimens are: 108 x 77, 98 x 74, 96 x 75, 108 x 76, 101 x 76, 107 x 75.

Pygoscelis papua (Forster).

Pygoscelis papua Cat. B. Brit. Mus., XXVI, p. 631.

This species, the "gentoo" of the Falkland Islands, is known to English-speaking seafarers as the "johnny" penguin. We saw the first examples on the southward voyage in latitude 43° 18′ S., longitude 41° 10′ W., on November 15, 1912. Cold westerly winds had raised a heavy swell on this day, and just before nightfall penguins began to pass the ship in couples or small groups, all swimming in a northerly direction. They remained below the water most of the time, but their braying calls frequently attracted attention to sleek heads and upright tails, the only visible parts of birds at the surface. From time to time a few more were seen before we entered Cumberland Bay, South Georgia, on November 24.

During our stay at South Georgia I visited seven populous rookeries of the johnny penguins, besides a number of incipient or decadent settlements which consisted of only a few nests. The situations chosen for the rookeries were so diverse that several of them are worth contrasting.

Two rookeries near the Nordenskjöld Glacier, Cumberland Bay, lay in wet, hummocky meadows, barely higher than sea level and crossed by several streams.

A rookery on the west shore of Possession Bay occupied a dell of less than an acre in area, hemmed in by the talus of bold hills which rose to an altitude of 450 meters on three sides. This rookery was filled with a luxuriant growth of tussock grass (*Poa flabellata*), and the ground was well drained.

The largest rookery that we discovered, comprising between four and five thousand birds, was distributed over knolls and ridges behind a great moraine-beach at the Bay of Isles. The site is bounded by two glaciers so that it can be reached only from the bay. In 1912-13 the penguin settlements, beginning on low ground a kilometer from the waterfront, extended inland and up the hills to a height of about two hundred meters. As long as young penguins were on this nesting ground, processions of adults might at all times be seen coming and going between the high land and the sea. The birds met and passed each other without a visible sign of recognition, each trundling gravely along on its own business. A broad thoroughfare had been stamped across the moraine, worn down doubtless through generations of the pattering of little leathery feet, and deeply grooved, sinuous avenues extended up the long snowbanks to the highest portions of the colony two kilometers from the shore.

The type of rookery last described is common at South Georgia wherever high land is at all accessible. No matter how much available territory there may be near the water, no matter how wearisome the scramble up the hillsides, a certain proportion of the members of each

1, 2. Johnny penguins sunning themselves on the beach of Cumberland Bay, Nov 25, 1912.

3. Walking up to the camera. Bay of Isles, Dec. 23, 1912.

colony usually selects the summits of the windy, shelterless ridges for its home. Why should marine birds which lack altogether the power of flight, and which are at best indifferent walkers, prefer to make the period of propagation difficult for themselves by retreating as far as possible from their only source of food? The question has already been raised by Levick (1914) with reference to the great colony of *Pygoscelis adeliæ* at Cape Adare, where many of the breeders climb to the bare crest of the cape and make their nests three hundred meters above sea level.* In the case of neither *P. papua* at South Georgia nor *P. adeliæ* at Cape Adare can the factor of self-protection offer a satisfying explanation, for both species have only a single terrestrial enemy, the skua, to the ravages of which they are as susceptible on the highlands as on the shore. Dr. Levick does not explain the fact, merely saying that it is "the result of their love of climbing." A consideration of the history of South Georgia, however, may help in an interpretation of the strange instinct which drives penguins of the genera *Pygoscelis* and *Eudyptes* to nest among the hills.

Although South Georgia is little larger than Long Island, N. Y., its glaciers are as mighty as those of Spitzbergen, and there is ample evidence that the island was formerly completely buried by an ice-cap. The interior, which rises to an altitude of more than two thousand meters, is no longer ice-clad, excepting on the peaks, but is covered with an everlasting névé of the Alpine type. This consolidates at the sources of all the valleys to form tongues of ice, most of which extend clear into the sea, ending in abrupt walls. Since most of the fiords have been carved out by former extensions of the valley glaciers, the coast is almost beachless, the few areas of low, flat land being terminal moraines or beds of moribund or extinct glaciers. Even now, with the fluctuating seasons, the glaciers sometimes advance their fronts and flanks over considerable ground once abandoned.† It is probable, however, that glaciation is on the wane and that an appreciable decline has taken place even since the visit of James Cook in 1775. Certainly Captain Cook's detailed account of unmelting ice and the absence of fresh-water streams in midsummer does not accord with present conditions.

From the foregoing data it may be assumed that during a long period following the last complete glaciation, very little territory suitable for breeding purposes was exposed. Whatever bare earth existed must have been found along the ridges which separated the ice-filled valleys. During such a period, before the parent stem of the *Pygoscelis* group had been differentiated into several species, these small penguins may have developed the trait which still leads them to seek lofty places for their nests. The fact that South Georgia was formerly the home of a far more abundant fauna than at present would have tended to fix the "mountaineering" instinct, for animals obtaining their sustenance only in the sea would have a tendency to increase more rapidly than the proportionate area of the beaches, and through sheer overflow of population many birds would be forced to content themselves with the less accessible ground, leaving the shores to great herds of summering seals,* and the adjacent nesting-sites to powerful rivals such as the *Aptenodytes* penguins. Then there is the factor of floods, whether caused by excessive thaws or by exceptional tides impelled by storms. At the Bay of Isles I found not only masses of kelp but also the heavy skull of a killer whale (*Orca*) far back on the great moraine-beach where it seemed almost incredible that the sea could have carried them. Because of the elevation of their nests the *Pygoscelis* penguins are more secure against floods than the *Aptenodytes*. Possibly this accounts in part for the greater numerical strength of the former, for although *Pygoscelis* lays one more egg than its larger relative, the king penguin's single offspring seldom if ever becomes the prey of the skua, which plays such havoc among the rookeries of the johnnies.

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* The same trait is equally well illustrated at Macquarie Island by one or more species of crested penguins (*Eudyptes*), a preliminary account of which is given in Mawson's *The Home of the Blizzard*, London, 1915.

† *Cf.* Murphy, R. C. *Petermann's Mitteil.*, Gotha, Vol. 60, 1914, (Mai-Heft) p. 280.

The hypothesis which I have advanced would be as applicable to any other austral region as to South Georgia, for the same physiographic and biological conditions have doubtless obtained throughout a wide circumpolar belt.

The faith which the johnny penguins hold in the protectiveness of high land is strangely shown by their habit of running *away* from the water whenever danger threatens. Their enemy, the sea leopard, has fixed within them an instinct which urges them to seek safety only on *terra firma*. Consequently they do not govern their acts according to their perceptions. Time and again I have seen a group of them standing at the water's edge when a fox terrier, brought ashore from the *Daisy*, started toward them at a run. If the penguins deigned to show any fear

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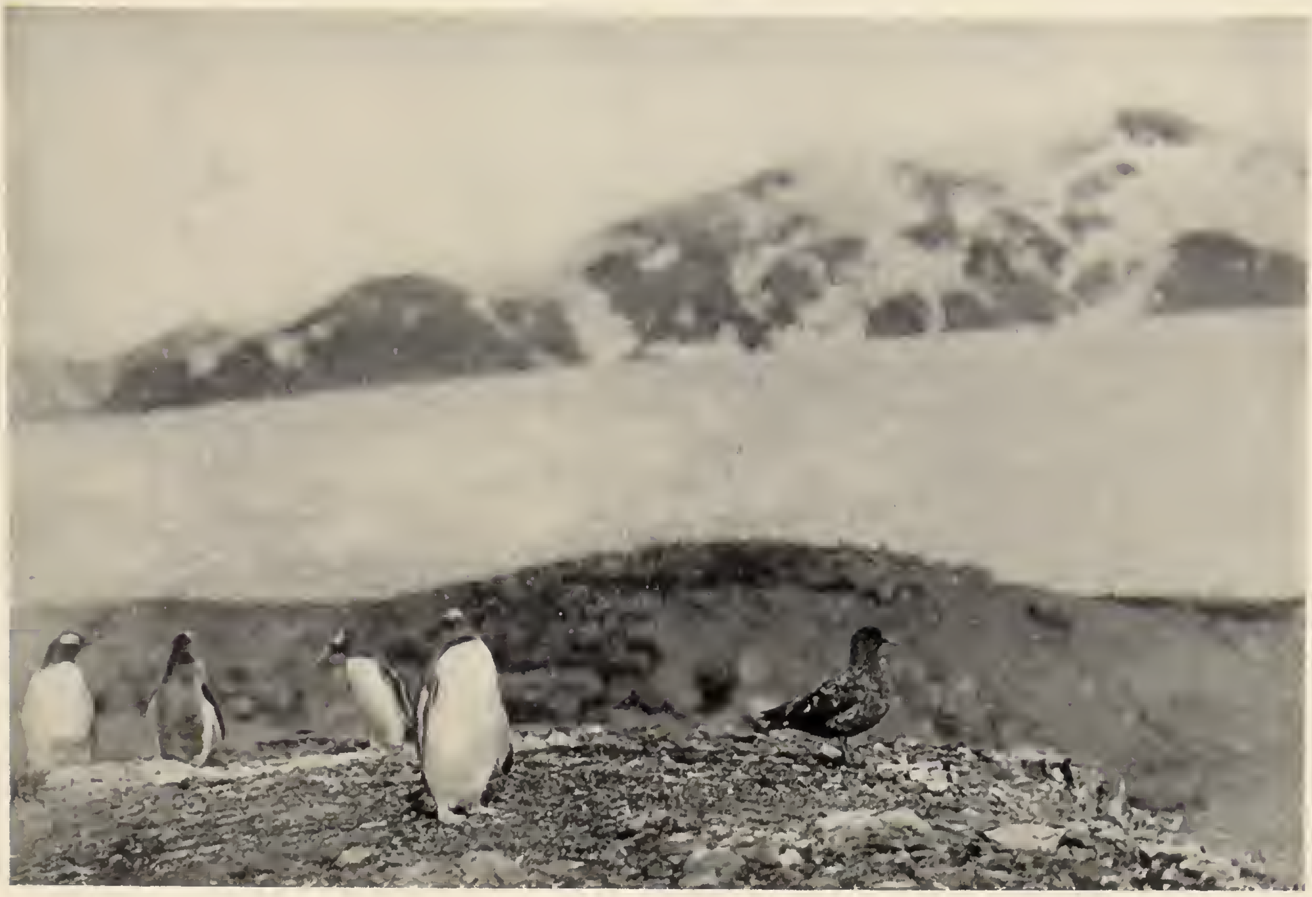
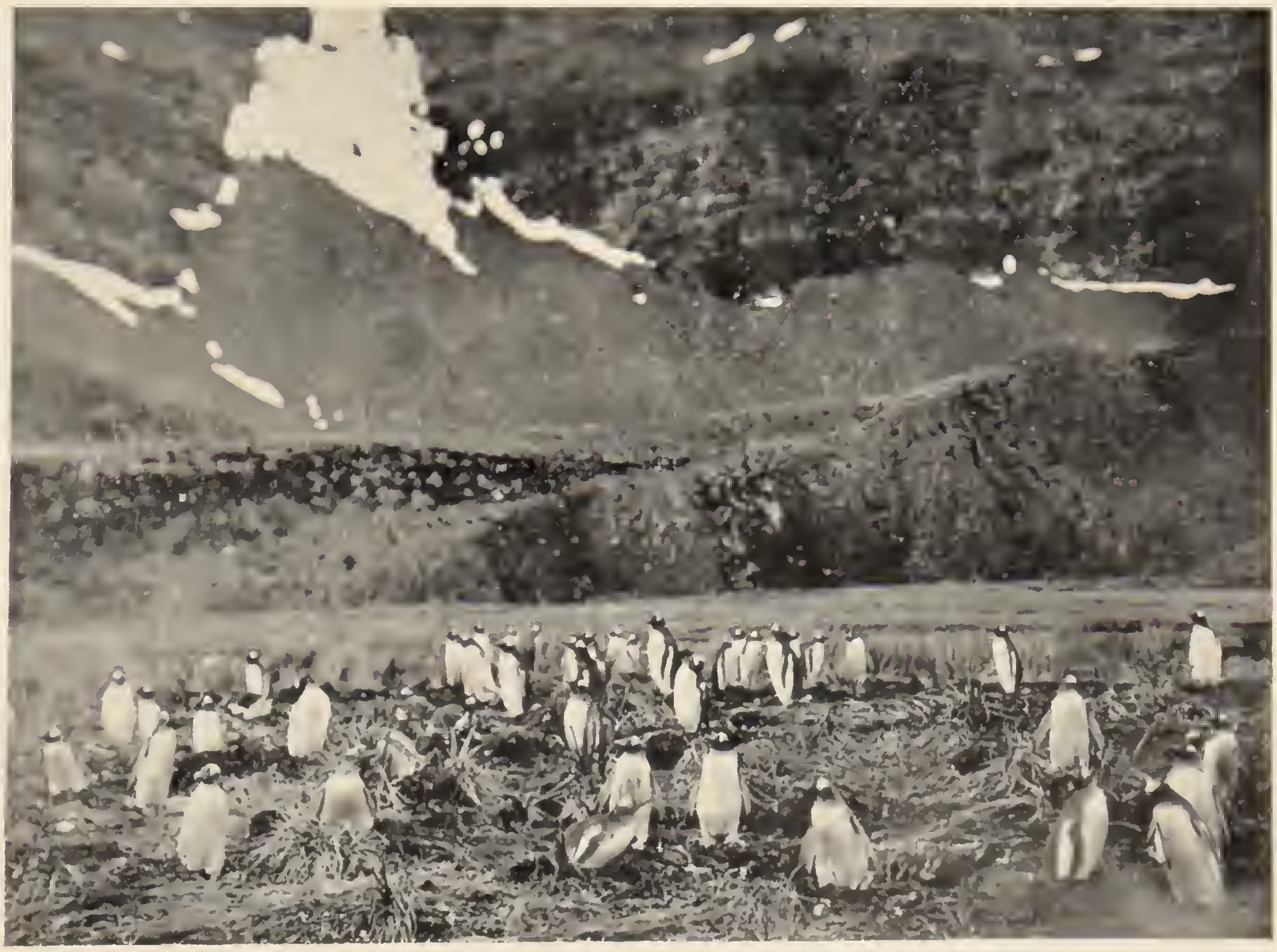
* At South Georgia I have seen sea elephants (*Mirounga leonina*) drag themselves so far from the water that they became a blind menace to johnny penguin nests on low ground at the outskirts of a rookery.



1. The summit of the large *Pygoscelis* colony at the Bay of Isles, Jan. 10, 1913. The undersized nest at the left was the highest of the whole colony. Just after the picture was taken, the johnny in the foreground made a furious rush at his near-by enemy, the skua. In the background is Lucas Glacier.



2. Colony in a low meadow near Nordenskjöld Glacier, Cumberland Bay, Dec. 3, 1912.

at the approach of the barking dog they invariably responded not by taking to the water, where they would have been rid immediately of the tormentor, but by deliberately running *up* the beach, heading for the nearest bank or hillside. Even after the dog had seized a penguin by its bristly tail and had swung it round and round merely for the fun of teasing, the poor dazed victim would still persist in scampering away from the water. I myself often found that the surest way to keep penguins ashore was to try to drive them into the sea. At Cumberland Bay, however, where several hundred whalemen have dwelt for a number of years, some of the penguins have adapted themselves to the new conditions, and I saw birds in the neighborhood of the whaling station take promptly to the water when they were chased.* Klutschak also cites an instance in which the johnny penguins had profited very quickly by bitter experience. He writes:

> In spite of their ingenuousness, the penguins have also much cunning as the following episode will demonstrate. These birds usually lay their eggs among patches of sparse grass at an elevation of several hundred feet above the sea. Our Portuguese sailors, tiring of the ship's fare, climbed a hill one evening, drove away the penguins, and gathered up all the eggs that they could find. At a later date they repeated the raid, but, trying it a third time, they found neither eggs nor birds. Then for several days no penguin was seen. But one morning our attention was called to some white specks moving down the abrupt slope of a mountain toward the sea. The specks proved to be our penguins descending for their bath. After several hours they climbed up again to their new village where they had found security for themselves and their eggs, for our Cape Verders, as much as they would have liked another feast, were too lazy to attempt the difficult ascent. (Translation).

The antiquity of the hill-climbing instinct among the johnny penguins of South Georgia is attested by a strange and romantic phenomenon, namely that the penguins go back to the heights to die. In a hollow at the summit of the coast range south of the Bay of Isles lies a clear lake on a bed of ice-cracked stones. This transparent pool, formed entirely of snow-water, with a maximum depth of three or four meters, is a penguin graveyard. In January, 1913, I found its bottom thickly strewn with the bodies of penguins which had outlived the perils of the sea and had apparently accomplished the rare feat among wild animals of dying a natural death. They lay by scores all over the stony bed of the pool, mostly on their backs with pinions outstretched, their breasts reflecting gleams of white from the deeper water. Safe from sea leopards in the ocean and from skuas ashore, they took their last rest. For months, perhaps years, they would undergo no bodily change in their frigid graves.

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* Sharpe writes of *P. papua* at Kerguelen: "When they became accustomed to being chased by men, the penguins acquired the habit of betaking themselves to the water at the first alarm."

The nests of *Pygoscelis papua* at South Georgia are more or less bulky mounds of humus and wisps of tussock grass, usually though not always on a foundation of small stones. Sometimes the floor, of the nest is lined with a mosaic of pebbles on which the eggs rest. Nests on the hill-tops are smaller than most of those on low ground, doubtless because of scarcity of vegetation in the former situations. In crowded parts of the colonies I saw a few nests built on the tops of glacial boulders about a meter high. The birds are notorious for stealing each other's nesting material.

Both parents incubate, relieving each other at intervals of several days. The change is made quickly so that the eggs are never exposed more than momentarily. On the lower belly of the sitting birds is a narrow, longitudinal area of bare skin, scarcely discernible on a dead penguin, but capable of being spread by voluntary muscles. This warm, vascular brood-patch is applied directly to the two eggs* which lie one before the other under the bird. After the eggs have cracked it still remains a serious proposition for the young penguins, which are extraordinarily feeble during the first few days of life, to work their way out of their thick-shelled prisons.

The nesting johnny penguins are generally timid, scampering off at the approach of a man, but never retreating more than a few paces. A small proportion of them stand their ground on the nests and show fight, employing as weapons both bill and wings. With the latter they can strike rapid and forceful blows. On one occasion a bird which I had roused from sleep attacked me and beat such a furious tattoo upon my leather leggings that its own pinions were soon bleeding. When a brooding penguin is driven away from young nestlings, it lingers near by, trumpeting loudly until the disturbance is over; then it examines its offspring very minutely, stooping down near-sightedly, and scrutinizing one and the other over and over again. When satisfied that all is well, it settles down contentedly. The incubating birds turn around in their nests so as to keep their bills pointed toward the skuas that walk about the rookeries with evil purpose and wait patiently hour after hour for a chance to steal an egg. Eternal vigilance is the price of safety for the

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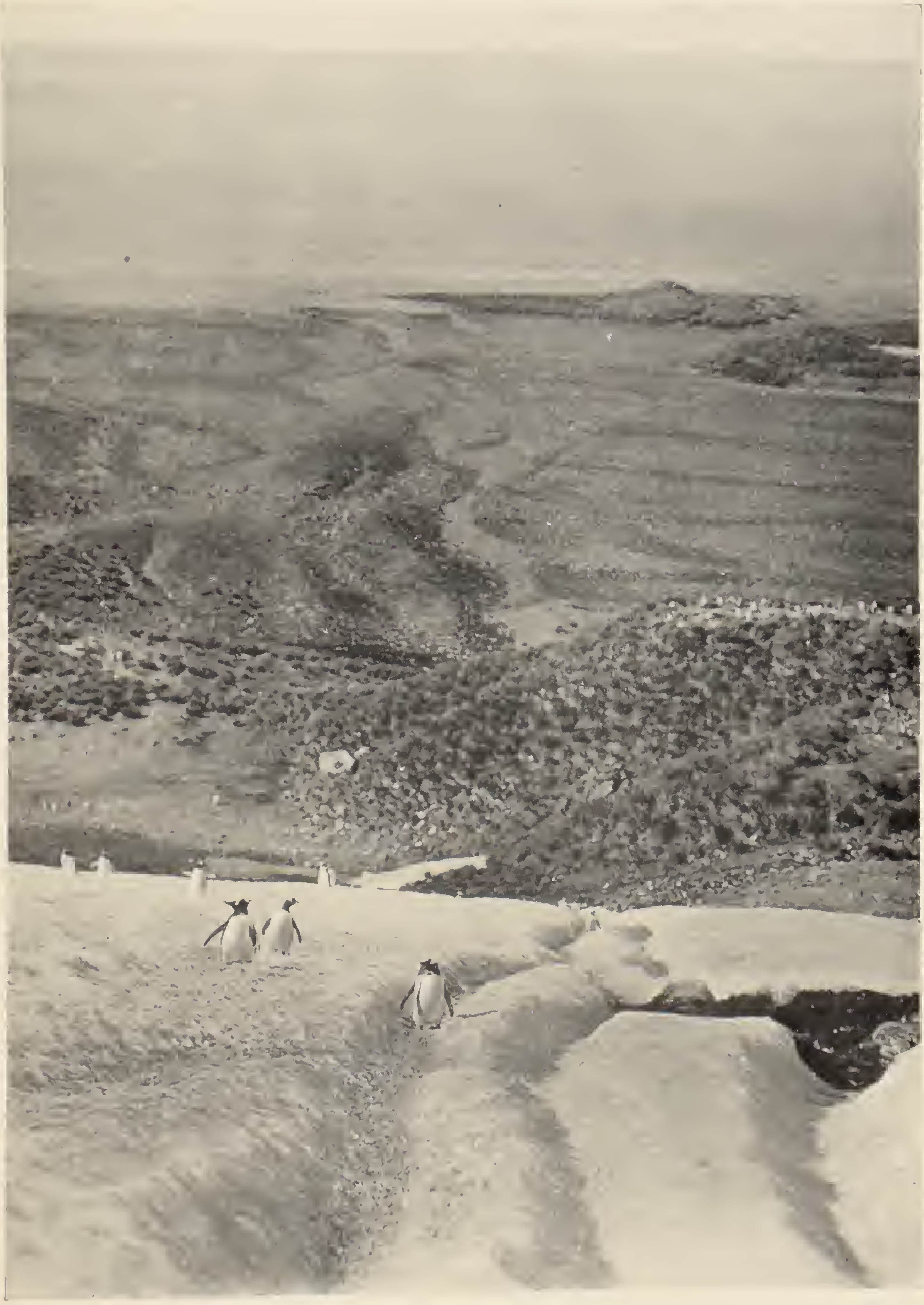
* At the South Orkneys, according to Eagle Clarke, the eggs of *P. papua* "were usually two in number, frequently only one, never three." At South Georgia von den Steinen twice found nests containing three eggs. The period of incubation is about thirty-three days.



The long road from the sea to the hilltop colony. Bay of Isles, Jan. 10, 1913.

penguins. The sitters hiss sharply whenever a skua draws near, and the unoccupied penguins make angry but vain rushes at the common enemy.

Besides the hiss of wrath the johnny penguins have a variety of louder calls. The ordinary trumpeting note sounds like the noise of a tin horn or the braying of an ass; the sound is double, being produced by both expiration and inspiration, and is accompanied by a rising and falling of the lower throat between the branches of the furculum.[*] The voice is pitched in a much lower key than that of the king penguin. Usually the head is pointed upward while the penguin trumpets. The mouth is held wide open, with the spiny tongue showing, and in cool weather the expelled breath condenses into clouds of vapor. The trumpetings are often repeated many times without interruption; under excitement the birds' whole bodily energy seems to be put into the call. Another note is a short, single "caw," which the penguins are apt to utter as soon as they emerge from the sea. This call sounds like a hail from one man to another, and the human suggestion is enhanced by the penguins' habit of waving their flippers as if beckoning. The weak trumpetings of nestling johnnies have a peevish, scolding quality, even hysterical at times. The youngsters have also a soft, peeping note, indicative of well-fed contentment.

By the time of our arrival at South Georgia the nesting season had begun,[†] and two Cumberland Bay rookeries which I visited on December 3, had already been robbed of their eggs by the crew of a Norwegian whaling steamer. The birds had, nevertheless, begun to lay a second time,[‡] and most of the nests contained at least one fresh egg. Among the eggs were several "runts," possibly the result of the abnormal ovulation. The smallest of these imperfect eggs, which contained no yolks, measured only 24 x 20.5 millimeters.

On December 23 the large rookery at the Bay of Isles, which had not been disturbed by human beings, contained plenty of young penguins, the oldest of which seemed to be half-grown.* Some of the nests held one egg and one chick, and among the further advanced families there was a great difference in the size of the two chicks due to the discrepancy in their dates of hatching, which sometimes amounted to four days. Not infrequently the senior chick was fully twice as large as its nest-mate. Nests which contained nothing but one youngster were also very numerous; doubtless the skuas, which were ever eyeing the rookery from points of vantage round about, had accounted for the other.

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[*] The sound can be faintly reproduced with the syrinx of a dead penguin.

[†] Von den Steinen records that courtship begins toward the end of September. He found the first eggs at Royal Bay on Oct. 26, 1882. At Kerguelen Island eggs are common early in September.

Writing of the species at the Falkland Islands, Abbott, *l. c.*, says that some of their breeding places are "several miles inland," and that the birds "commence laying almost always on the same day, *viz.* 7th Octobor."

[‡] Kidder collected at Kerguelen Island eggs of this species which, he believed, "must have been at least the ninth or tenth laying since the season commenced." Six consecutive layings have been observed at South Georgia after the loss of eggs. Von den Steinen points out that eggs of the second and later broods are smaller and rounder than those of the first. Moreover the size of the set becomes reduced to one egg.

The youngsters are fed from the crops of the old birds and grow very rapidly, early development showing especially in the abdominal part of the body. Within three or four days of hatching, the chicks become veritably anchored in the nest by the weight of their corpulent bellies which seem out of all proportion to the puny neck and wings, and the soft, insufficient legs. Within these distended stomachs I found disintegrated crustaceans, small cephalopod beaks, and pebbles. The only identifiable food material found in the alimentary tract of adults was examples of the pelagic, mysidaceous shrimp, *Antarctomysis maxima*.

On December 29 many of the young penguins were half-grown, although a good proportion of nests still contained eggs. By January 10 only one nest in about thirty held eggs, and on January 24 no eggs remained excepting a very few addled sets still covered by the patient parents.

By the middle of January the young were mostly two-thirds grown, and their incessant chattering could be heard a long way from the rookeries. The older youngsters walked about in an uncertain, wobbly fashion, tagging after their fathers and mothers and trumpeting nervously when left too far behind. When I walked among the nests, all but the youngest chicks left them and herded together. The brooding adults, too, rushed away, but a few squeaks from the abandoned little ones usually brought them back, scampering hither and thither and swinging their wings frantically. If the youngsters happened to be old enough to walk, the parents coaxed them along by giving small tastes of food, with promises of more, but in hysterical fashion they would soon forget to wait for their feeble babies, and would have to be called back repeatedly. The youngsters, even when very large, are fond of snuggling as closely as possible against their parents.

When caught in the hand, the fledglings strike with their harmless little wings and attempt to bite, at the same time protesting with high-

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* Von den Steinen observed the first young on Nov. 28.

1. Sea leopard (*Hydrurga*), yawning in contented leisure on the floe ice in front of Grace Glacier. The widely opened mouth of the animal faces the camera. After a meal of penguins, these seals often come out of the water for a nap.

2. Johnny penguin in the graveyard pool, Bay of Isles, rolling its back above the surface. The bird is swimming toward the right of the scene.

pitched voices. After a few moments, however, they become absurdly tame and confident, and enjoy having their plushlike backs stroked.

By the end of January all but a very few of the young penguins, still clad in the softest of gray and white "fur," had permanently deserted the nests and had congregated by themselves, but always under the guard of adult nurses. In fine weather they might be seen sunning themselves on the snowbanks, and at other times crouching from the wind in sheltered hollows. Some of them were as large as the adults, but they were still dependent for their food, and they had not yet been to the seashore. I often saw them pleading to be fed when the old birds evidently did not wish to gratify them. Such begging youngsters ran about after the adults, following every dodge and turn, continually bumping into them and stepping on their tails until the harassed adults gave up in despair. The young ones would then press closely against the provider, open their little bills expectantly, and lose nothing of the regurgitated meal.

Young penguins do not go into the sea until they have lost completely their coat of down. In this respect they differ from all other aquatic birds, and since the molt of the down is so important an event in the johnny penguin's economy, the plumage sequence should be treated of in connection with growth. On emerging from the shell the young johnnies are clad in a nearly uniform covering of straight filaments, whitish or light gray except on the top of the head, where they are of a dark slate color. These natal filaments are attached to the tips of the juvenal down feathers, which are highly complex and dense, and which sprout within a few days after hatching, clothing the nestling in dark gray and white, on the dorsal and ventral surfaces respectively. The wings are included in this vestment of woolly down. Traces of the frail natal down cling to the new coat for some time, but eventually disappear through wear. The egg tooth adheres to the young penguin's bill until the bird is nearly fully grown.

About the first of February most of the young begin molting the juvenal down, thus exposing the adult plumage feathers which have grown out beneath. The appearance of the white head-spots is the signal of the coming change. The down is shed in sheets and patches; the process resembles the peeling of the velvet from a deer's horn. By the middle of February, or toward the close of the molting period, clinging tufts, collars, or top-nots of down give the otherwise smooth young penguins the appearance of clowns and pierrots. The last of the down to go is that on the hind-head, neck, an shoulders. When the changed has been completed the youngsters are distinguishable from their elders only by their sleeker appearance, short tails, pale feet, small, light-colored bills, and voices which are unmistakably childish. At this age they still remain together in bands, and spend a good deal of the day in sleeping. They are, however, quite as inquisitive as the old birds. Until the end of February or later they are dependent for their food, and they are fed at least partially by regurgitation up to the middle of March.

On March 12, at the rookery on the west shore of Possession Bay, I saw many fully grown young penguins following the old birds and demanding food. One youngster chased a sorry looking adult to the water's edge where the latter turned and proceeded to pump up a meal. After a few moments, however, this persecuted parent, or foster parent, tore away, plunged under a breaking wave and was lost to view. The insatiable young penguin followed it into the surf but came out again discomfited within a few seconds.

The postjuvenal molt of the nestling johnny penguins is succeeded closely by the annual postnuptial molt of the adults. Toward the end of February the feathers of the latter, already much faded and frayed, begin to drop out, further to litter up the ground of the rookeries, which have become evil-smelling and filthy from the surface mixture of mud, decaying tussock grass, excrement, down feathers, and dead nestlings. The molting season of the adults seems to endure all through the summer, the plumage coming off in patches. A period of several days intervenes between the loss of the contour feathers and of the long, stiff rectrices.* On March 12 I observed that a few of the adults had not yet begun to doff their old coats, which were brown, rough, and threadbare. Many more, the majority of the birds in fact, were in the throes of the process and were exceedingly ragged, the new plumage showing in spots. Others had completed the molt of the body feathers, but still retained their long tails, while the most advanced birds had dropped all their old feathers including the rectrices, a temporary loss which gave them a more dumpy outline than ever; for appearance sake a johnny can ill afford to be without its luxuriant tail. There is also a practical disadvantage, since these birds use the stiff, bristly tail feathers as a prop. Certain changes

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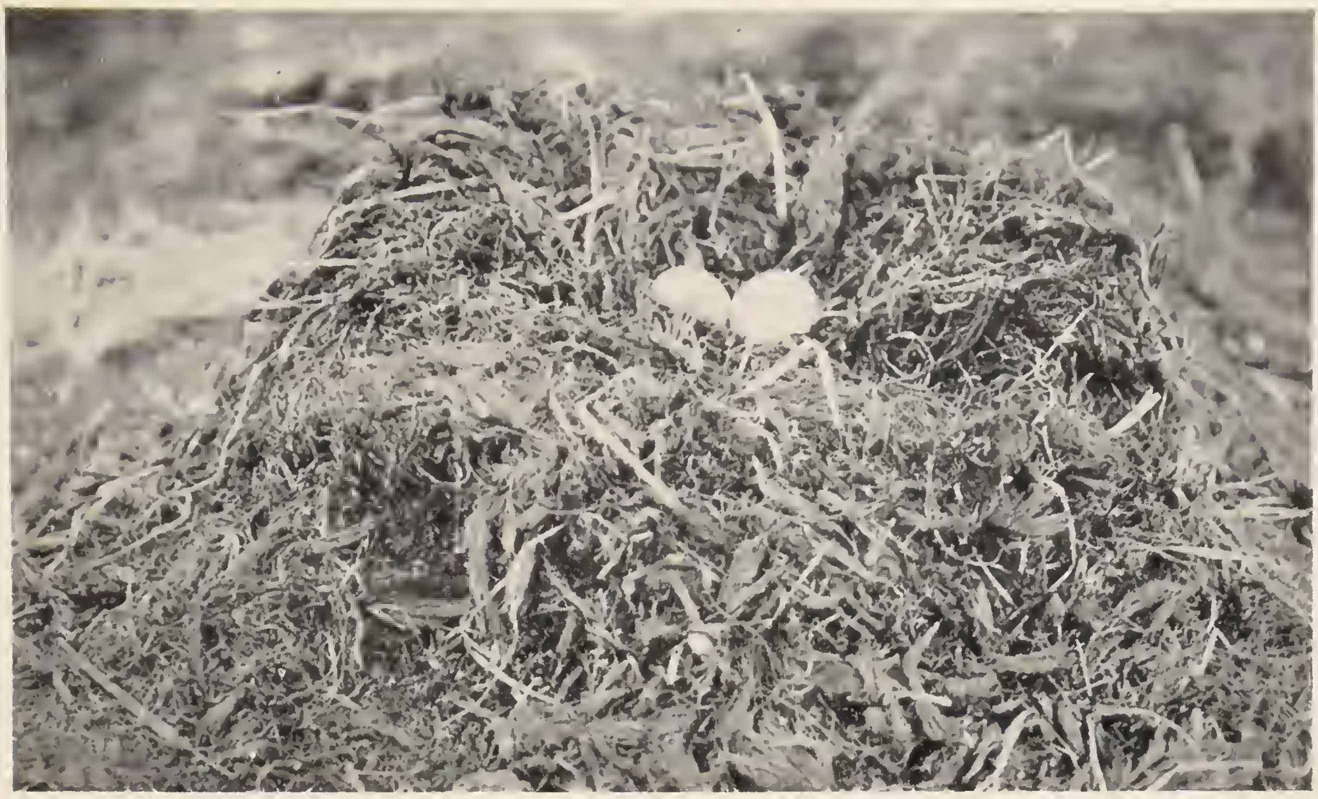
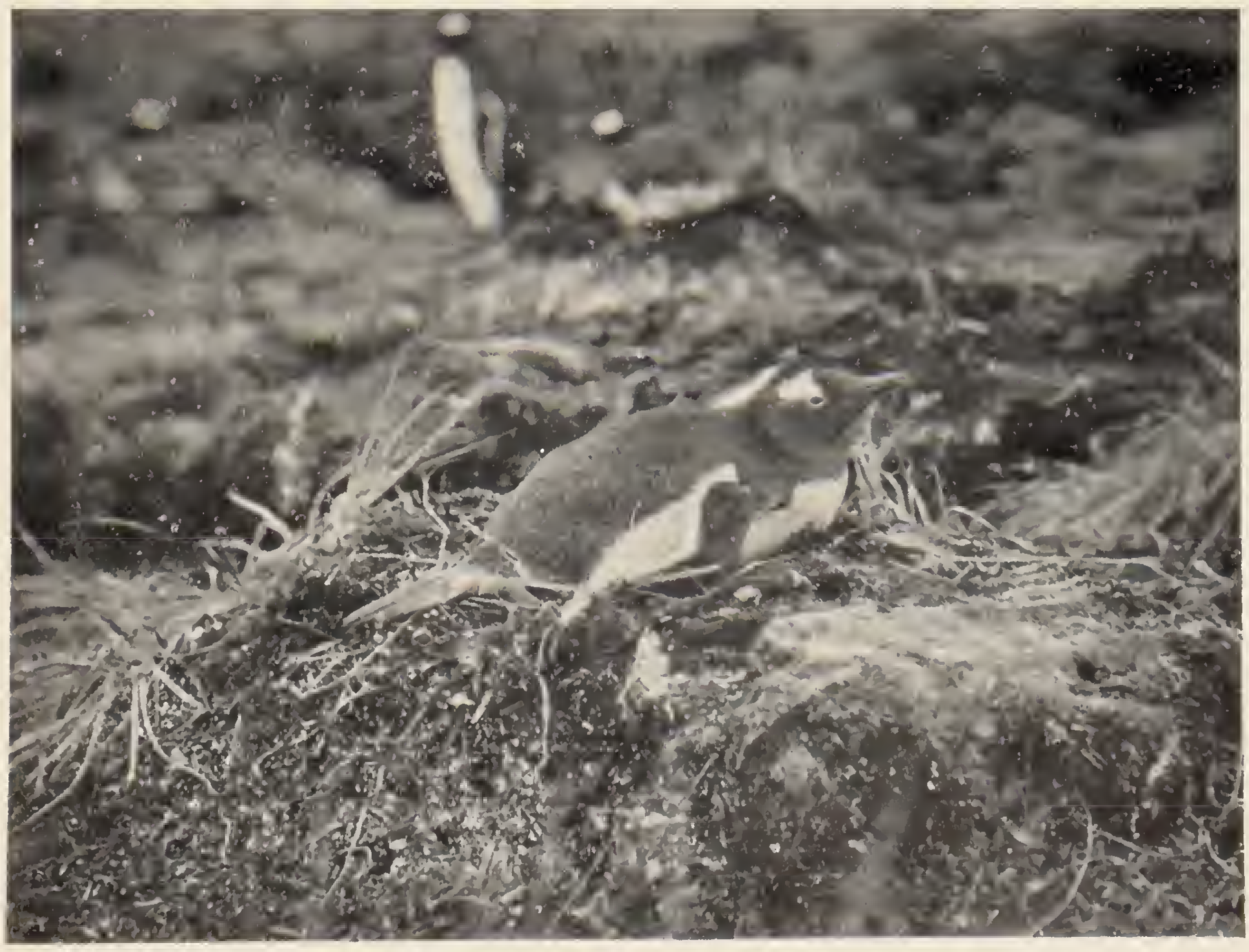
* Seth-Smith *l. c.* records that the rectrices of a captive king penguin were the first feathers to be molted. This is also in accord with the testimony of other observers of penguins. I, however, saw many freshly-molted examples of *P. papua* with long tails.



1. An unusually bulky nest of the johnny penguin, in a meadow colony at Cumberland Bay. Dec. 3, 1912.



2. Johnny penguin on its nest, which is situated on top of an old hummock. The flexure of the bird's wing is noteworthy.

in the colors of soft parts accompany the postnuptial molt. With the change to the new plumage the birds acquire orange feet, and the inner surface of the wings, salmon pink in color during the breeding season, now becomes white or nearly so.

Pygoscelis papua has not in any degree the fearless and courageous disposition of its Antarctic congener, *Pygoscelis adeliæ*. On the contrary, bands of johnnies along the beaches are prone to take alarm if a man appears suddenly among them. The most successful course of action is to approach them slowly, halting at a discreet distance and so inviting the penguins to take the initiative. They have a large bump of curiosity and will presently push the acquaintance, their familiarity increasing in direct proportion to the quietness and seeming indifference of the observer. A description taken from my notes of December 23, 1912, is characteristic. On the afternoon of this day I walked to a glacial pond on the far side of which stood a group of johnny penguins. As soon as they saw me one of their number swam across under water and walked toward me. I remained motionless until it came up quite to my feet and stood there. When I moved quietly it followed, and when I stopped it did likewise. Then, one by one it was joined by the other penguins from across the pond. It was whimsical to see this troop of mimicking small brothers with no other wish than to keep me company. I finally broke the spell by stooping to pat one on the head, when they all wiggled their tails, hurried back into the pond, and swam across like porpoises.

On March 12 I rowed ashore during a brisk snowstorm and found a whole army of penguins near the Possession Bay rookery before mentioned. They were standing by hundreds in a long double row along the beach. These rows marched forward to meet and surround me, and their numbers were continually augmented by new arrivals which kept popping out of the surf, and came running up the shingle as if much astonished to find me there.

The amusing, myopic curiosity of the johnny penguins is illustrated by the furtive way in which they inspect any striking or unfamiliar object. They pick up odd bits of kelp, bleached bones and other rubbish, carrying them for short distances, and I have seen a band of them walking around and around the fresh carcass of a seal, pecking at it with their bills.

I saw nothing to indicate that the johnny penguins* share the social pugnacity of *Pygoscelis adeliæ*. They would, indeed, sometimes fight boldly enough in defense of their young, as I have related. They would also protect themselves, with many loud outcries, from the attacks of our ship's fox terrier. Through hard experience the johnnies at the Bay of Isles learned to ward off the dog by huddling back to back in a sort of Macedonian phalanx, striking outward with quick wings at whatever point it attacked. But the nearest approach to a fight between two of the penguins that came to my notice was only a half-hearted affair. A couple came out of the surf one day, within a few feet of me, and immediately commenced to slap and prod one another. They continued merrily for perhaps a minute, when they spied me and, instantly forgetting their differences, came up the beach to have a close look at the intruder. In several instances I captured adult penguins by running them down. Such birds naturally attempted to bite and strike, but only for a few moments ; if their backs were stroked from neck to tail their accelerated docility would seem almost hypnotic.

The free penguins, *i. e.* those not incubating or brooding, spend much time sleeping, particularly on sunny days. They have two resting positions ; one sitting bolt upright with the head turned behind the shoulder and the bill tucked under the axilla ; the other lying flat on the breast with the feet bent forward among the feathers, the wings pressed against the sides, and the head drawn snugly back. The upright position is commonly maintained during a daytime doze, but birds discovered along the beaches after dark were always found to be sleeping upon their bellies. A nap is followed by the toilet, the penguins preening themselves with much care, fluffing out the entire plumage until each feather lies as smoothly as a scale.

The johnnies walk in a deliberate manner, raising their feet high at each step, carrying their tails well above the ground, thrusting their wings behind them as balances, and poking the head forward into the accustomed near-sighted attitude. Their near-sightedness is probably no less real than apparent, because of the specialization of their eyes for vision through a medium of water.

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* Eagle Clarke records exactly the opposite regarding this species at the South Orkneys. He says that "they fought fiercely among themselves, using both wings and bills." Dr. Henryk Arctowski, also, has informed the writer that *Pygoscelis papua* was regarded as the most pugnacious of the penguins in the regions visited by the *Belgica*. But the experience of Dr. Gain, Naturalist of the Charcot Expedition, is that this species differs from other penguins in that the birds *live in the greatest peace with one another !*

In crossing the stony or hummocky beaches that separate various arms of the bays, or which lead from the sea to the snow-water ponds in which the penguins delight to play, they follow regular, well-tramped avenues. When bent on a definite journey across the land, they trudge along very steadily and unconcernedly, and for the time seem to take no notice of their fellows. When in great haste, they fall upon the belly and run on all fours. By this well-known mode of progression, called "tobogganing," they can lead a man a very creditable chase. Their most curious attitude is assumed when they walk down an incline, such as a snow-bank or a steep beach. The head is then thrust so far forward that the straight neck and the spine form a right angle; the wings are held stiffly back as far as possible, and the round belly projects as the bird proceeds with gingerly steps. On rare occasions they hop instead of walking, springing with both feet from one beach pebble to another, in the manner of the true "rock-hopper" penguins (*Eudyptes*). Their fat bodies seem to be made to stand hard knocks, for not only do they tumble over frequently wherever the walking is rough on shore, but they also suffer fearful batterings on the shingle when they come out of the surf, sometimes being bowled over by four or five successive breakers before they can scramble out of the undertow.

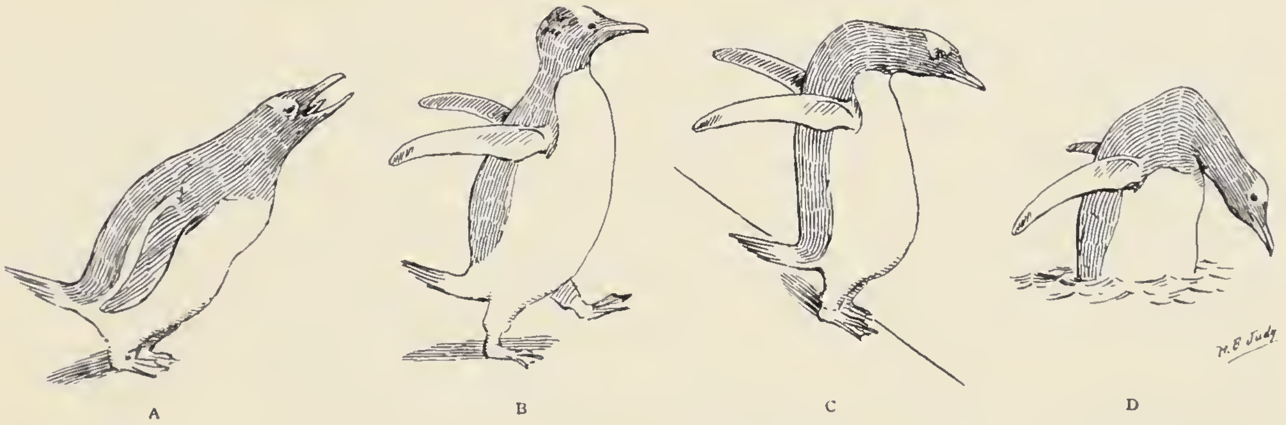
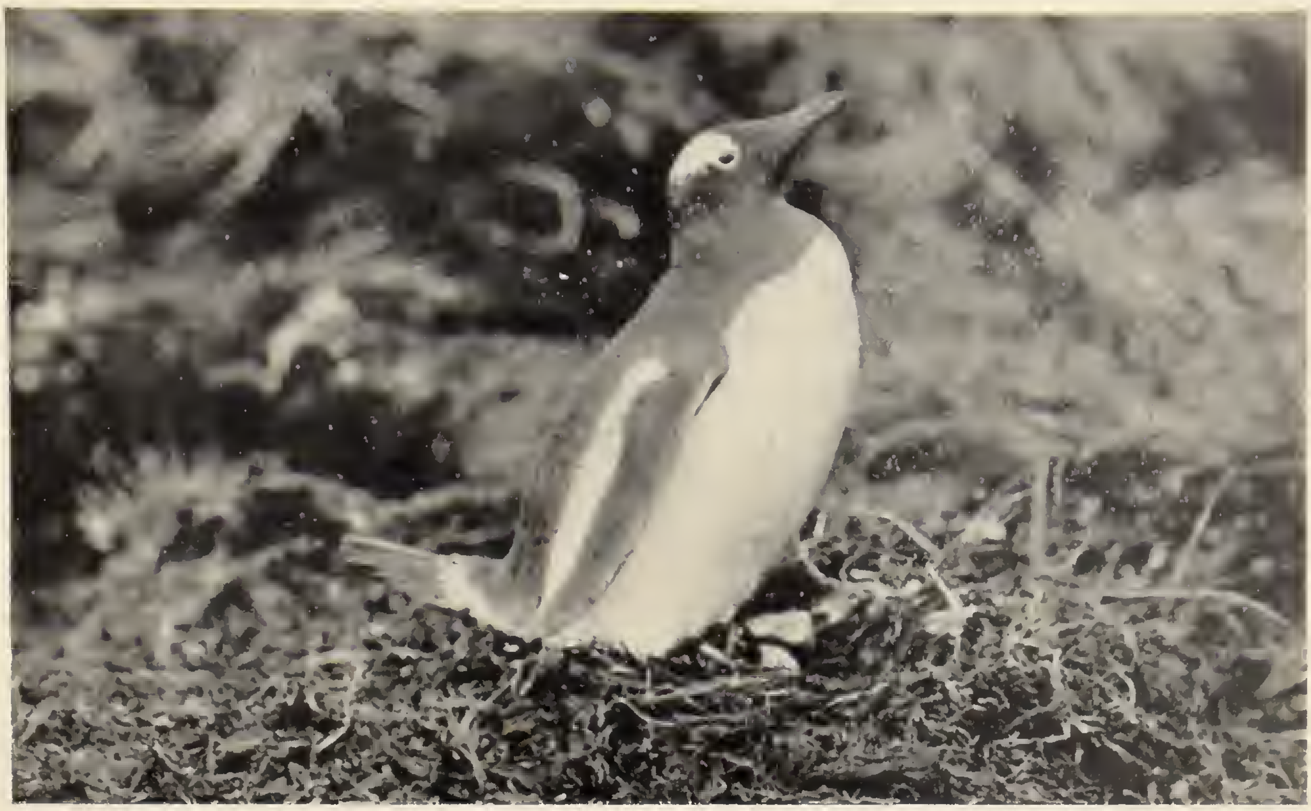


Fig. 3. *a.* Trumpeting. *b.* Walking on level ground. *c.* Descending a bank. *d.* Wading into the water.

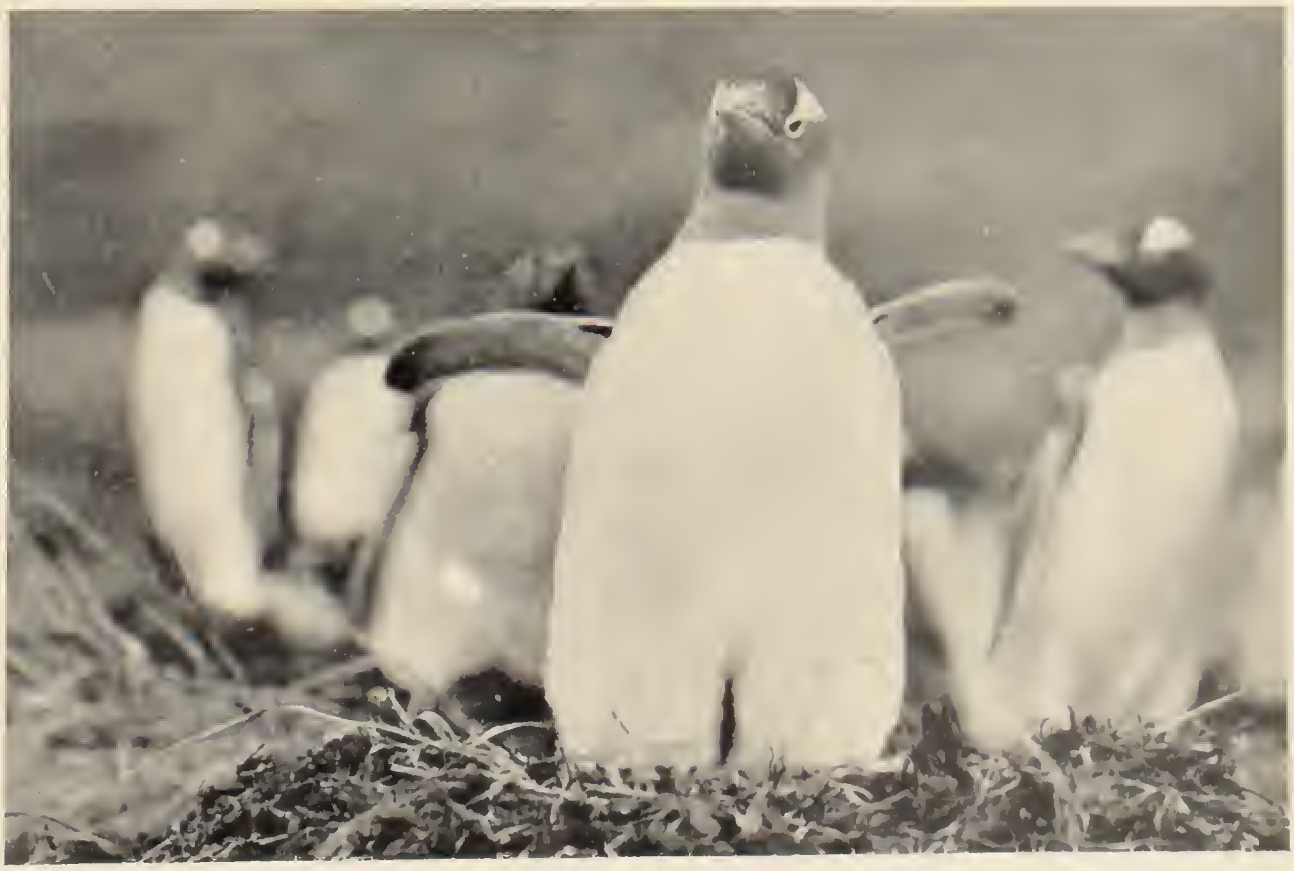
When wading into the water, the johnny penguins invariably round their shoulders, bend down their heads almost to their feet, and scoop beneath the surface as soon as there is depth enough to float them. Once under way, all their terrestrial awkwardness vanishes. They swim with well-nigh incredible speed, remaining below the surface except when they leap out porpoiselike, giving an audible gasp for air—to be gone again within the twinkling of an eye. So quickly is this leap completed, that penguins playing before the bows of a vessel, as I saw them from the bridge of a South Georgia whaling steamer, might easily be mistaken for jumping fish. Often while I was rowing in my dory between the brig and the shore, shoals of johnnies would swim around the small boat, and after long submergence would skip out of water five or six times in rapid succession. During the "porpoising" they hold the pinions straight out from the body, not pressed against the sides. The maximum length of the leap hardly exceeds two meters.

One evening I stood knee-deep in the water of the Bay of Isles and watched at close quarters four johnny penguins swimming. The sea was fairly calm, the water clear and brilliant in the sunset light. The quartet of penguins darted hither and thither all about me, now and again almost brushing my legs. Frequently they rolled their backs above the surface, and more rarely they leaped out. I distinctly observed that the strokes of their flippers were sometimes made alternately and sometimes in unison. Probably they were feeding, although I could not see their prey. Whether for sport or a more serious purpose, they occasionally swam in the ridge of an advancing swell, going so far up the beach that they were left stranded for a moment. Presently three of them walked out of the sea, shook the water from their tails, and became so immensely interested in watching me, that they pursued me for a while when I left the spot.

On another occasion, January 10, 1913, I witnessed an extraordinary diversion of the penguins in the graveyard pool mentioned on page 117. This pond, lying in a hollow of the hills, was bordered on three sides with a perpendicular bank of hard snow, the remaining shore being a stony slope. On the afternoon of my visit penguins were swimming in it, for pure enjoyment, of course, for there was no food, no living thing, not even a visible alga, in the transparent snow water. How alert and reptilian the penguins seemed in their own element! How unlike the inelegant, ridiculous creatures they are ashore! They dashed straightaway under water the length of the pond and back again, with a velocity which I had then an opportunity to compute as about ten meters a second. They chased each other other round and round, flashing into the air twice or thrice during their bursts of speed, every action plainly revealed through the clear, quiet water, with the white corpses down below. When the swimmers rested at the surface only the white-filleted head and up-pointed, ridged tail showed, as a rule, but somtimes they would float higher, like grebes. Several of them tried to leap out onto the bank of frozen snow which rose about a meter above the water. Strangely enough, they misjudged their distance repeatedly; they jumped too soon, and were on the downward segment of their arc before



1. Rising suspiciously from the nest. Dec. 3, 1912.



2. The "brood-patch," which the bird has spread as it is about to settle on the eggs. Ordinarily there is no outward sign of this bare area.

they had cleared the edge. I saw one individual try a dozen times and fail; it always leaped a few lengths too soon and whacked its shiny breast against the wall of ice. A group of birds, which had been sunning on a snow bank, entered the water as if by mutual agreement. Some of them walked to the rocky slope and waded, arching their necks and tucking their heads under water before they made the plunge. Others flopped off the edge of the ice. I say flopped because they did not make graceful standing dives, such as I had expected; on the contrary they entered with flagrant, splashing "belly-bumpers." All of the birds when first going into the water executed a curious maneuver, the object of which I do not understand. Immediately after the plunge they came to the surface and lay stiffly, first on one side of their bodies, then on the other, and beat with the uppermost wing and foot, kicking the latter back and forth, and rubbing the wing across the feathers of the side, as if trying to wet themselves thoroughly.*

The great discrepancy between *Pygoscelis papua* and *P. adeliæ* in jumping and diving ability is at first sight rather surprising. Through the medium of the films taken during the Australasian Antarctic Expedition I have seen the prodigious, salmonlike leaps of the plucky little Adélies, while the photographs of Levick well illustrate the graceful dives of these denizens of uttermost southern shores. It must be borne in mind, however, that *P. papua*, with a Subantarctic range, breeds on no land which has an ice-shelved coast. The ability to gain the land by a catapultic spring has doubtless vanished with the disappearance of the necessity for such a method. Occasionally I saw johnny penguins on the very brinks of South Georgia glaciers where they abutted on the bays, but in all such instances the birds had climbed up over a sloping edge, and they invariably returned by the same route.

The johnny penguins often feed far at sea, at least sixty or seventy kilometers from the coast of South Georgia, but during the long breeding season they apparently all return to the land for the night. In the late afternoon we usually saw long troops of them porpoising into the fiords from sea. This habit is so well known that sealers, overtaken in their boats by an impenetrable South Georgian fog, rely upon the homecoming penguins for the direction of the flat beaches.

Considering the fact that most natatorial birds swim as soon as they emerge from the shell, the tardiness of young penguins in taking to the water has been pointed out as a remarkable phenomenon. The explanation of this, however, is doubtless that the speed and stamina required in capturing living pelagic food, in escaping from the dreaded sea leopard, and in swimming through breaking surf, can not be developed early in life by birds which use the *wings* instead of the feet as propelling organs. Certainly the pinions of nestling penguins seem extraordinarily under-developed. The little birds begin to exercise them soon after birth by flapping them, weakly at first but vigorously later on, a trait that suggests ancestral aspirations for flight. The young johnnies never enter the water of their own accord until they have completed the post-juvenal molt. I was informed by sealers at South Georgia that the youngsters then receive from the adults a sort of discipline strongly reresembling "swimming lessons,"* but it was never my privilege to witness this interesting performance.† On many occasions I put nestlings of various ages, as well as fully grown, molting young, into the fresh water ponds where they proved themselves almost as helpless as human beings unfamiliar with swimming. They instinctively put their heads under water and tried to swim below the surface in the approved fashion, but it was a feat quite impossible for them. They beat the wings simultaneously, and bobbed up and down without making much progress. Such a scene always attracts a band of skuas to the spot, as if these ogres realized the helpless misery of a young penguin in the water. The skuas do not strike while their prospective victim is swimming, but pace along the shore waiting to intercept its landing. Once a half-grown youngster, with which I had been experimenting, crawled out of the grave-yard pool into the very jaws of seven skuas which attacked it *en masse*. The little penguin struck with its feeble wings and cried out piteously. Insignificant as it was, not one of the skuas dared seize it outright, but they made quick rushes from all sides, striking the penguin on the head with closed bills, and then retreating. I hurried to the rescue and restored the little bird to its nest where I afterwards saw it resting characteristically with its head hidden between its mother's warm, feathered thighs.

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* Writing of *Pygoscelis adeliæ*, Clarke, p. 229, reports: "After they dive they roll over and over in the water, and wash themselves thoroughly with the aid of their feet, gradually getting rid of the red dirt with which they are bespattered and smeared."

It seems to the writer that the name johnny penguin might well be

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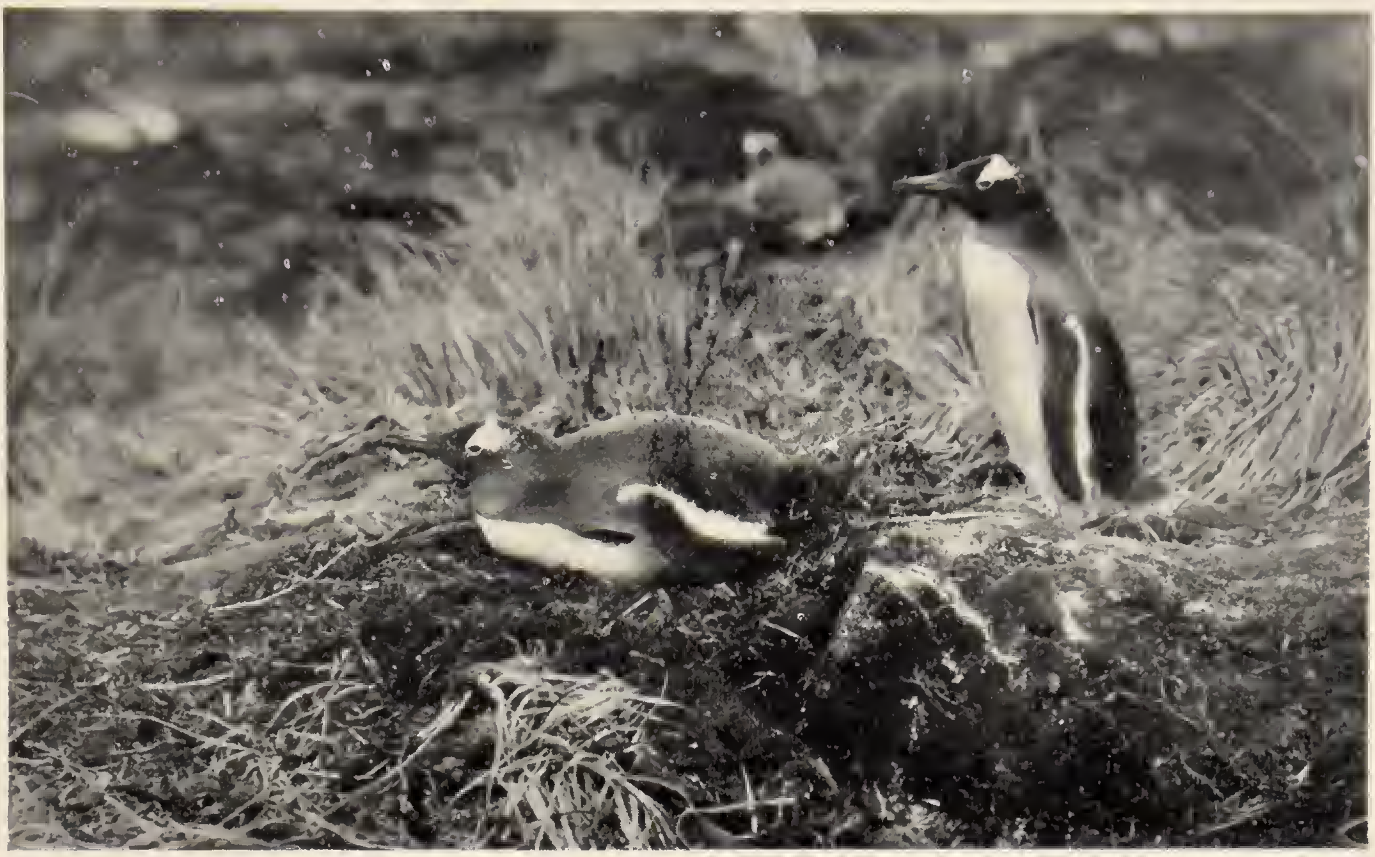
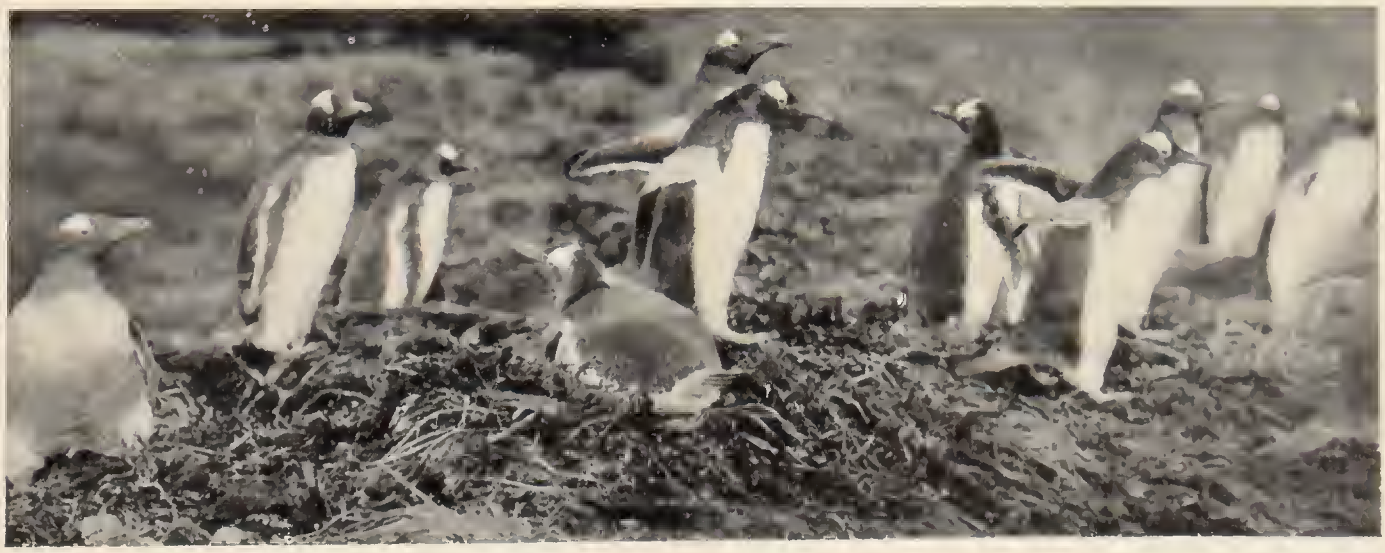
* Levick confirms the truth of this by his observations on the Adelie penguins.

† Most of the johnny penguins are said to migrate to sea during April, although a few linger about the shores of South Georgia into the winter. Dr. Gain of the *Pourquoi Pas* ascertained, by banding examples of *P. papua* at Petermann's Island, that the same birds come back to the same rookery year after year. It seems probable that the young spend nearly two years at sea before returning to breed.



1. About to "relieve guard." The white streaks on the hummock are excreta from the sitting bird. Cumberland Bay, Dec. 3, 1912.



2. Johnnies, setting their flippers as balances, and starting toward the sea. Dec. 3, 1912.

accepted as the book vernacular for *Pygoscelis papua*. "Papuan" penguin, which has been sometimes used, is grossly misleading, while "gentoo" is a term of East Indian origin, first employed by Europeans as synonomous with Hindu. "Johnny" is the sea name, of old standing and wide distribution, a genuine vernacular. It carries an appropriate connotation of roly-poly small-boyishness; it is a name which fits the bird.

Measurements in millimeters of ten specimens of *Pygoscelis papua* are as follows:

Collected Mar. 12, 1913	Bill from gape	Bill from nasal feathers	Wing from axilla	Tail	Foot
R. C. M. 1934 ♂ young	68	35	225	120	128
1936 ♂ ad.	72	41	242	140	143
1937 ♂ ad.	75	36	236	109	126
1938 ♂ ad.	85	45	234	140	137
1939 ♂ ad.	73	39	236	132	129
1940 ♂ ad.	82	39	241	29 (new)	131
1941 ♂ ad.	78	40	238	144	128
1932 ♀ ad.	77	39	237	12 (new)	129
1933 ♀ ad.	75	40	231	132	133
1935 ♀ young	62	30	220	112	117

In several examples collected or observed the white spots of the head were not joined by a band across the forehead.

The pupil of the eye in this species is rhombic when contracted.

The eggs are rounded or subspherical, greenish-white in color. In a series of eighteen, the measurements show no variation which is not comprised within the dimensions of one of the following four examples: 74 x 57 (longest); 62 x 54 (smallest); 65 x 57 (nearest to spherical); 73 x 59 (largest). In a typical set, the two eggs measure 70 x 59 and 72 x 60. A "runt" collected on December 16, measured only 46 x 47 mm. Such eggs are a product of reiterated laying. Von den Steinen found that the average weight of a series of eggs taken at Royal Bay was 137 grams.

Pygoscelis antarctica (Forster).

Pygoscelis antarctica Cat. B. Brit. Mus., XXVI, p. 634.

In company with one of the officers of the *Daisy* I made a foot journey over the mountain pass from Possession Bay to Antarctic Bay on

March 3, 1913. Our fox terrier presently began to worry two small penguins which stood on a pile of rock some four hundred meters back from the water. As soon as I heard the strident voices of the birds I knew that they were not *P. papua*, and on investigation they proved to be *P. antarctica*. A few minutes afterwards I met a third in the midst of a flock of a dozen *papua*. The presence of the stranger was evidently not welcomed for several of the johnny penguins were pecking and striking it.

All three of the ringed penguins were molting.

This species was found breeding at Royal Bay by the German Expedition of 1882-83. It is known, also, from the Falklands. It is not typically a Subantarctic form, however, its center of abundance being in West Antarctica and the out-lying islands.

Of my three specimens one was preserved in alcohol and another prepared as a skeleton. The measurements of the third, a skin, are :

	Bill from gape	Bill from nasal feathers	Wing from axilla	Tail	Foot
No. 1913 ♂ ad.	65	36	120	11	94

Irides straw-color.

Recently I have received a fourth specimen, a female collected at Cumberland Bay, South Georgia, in February 1915.

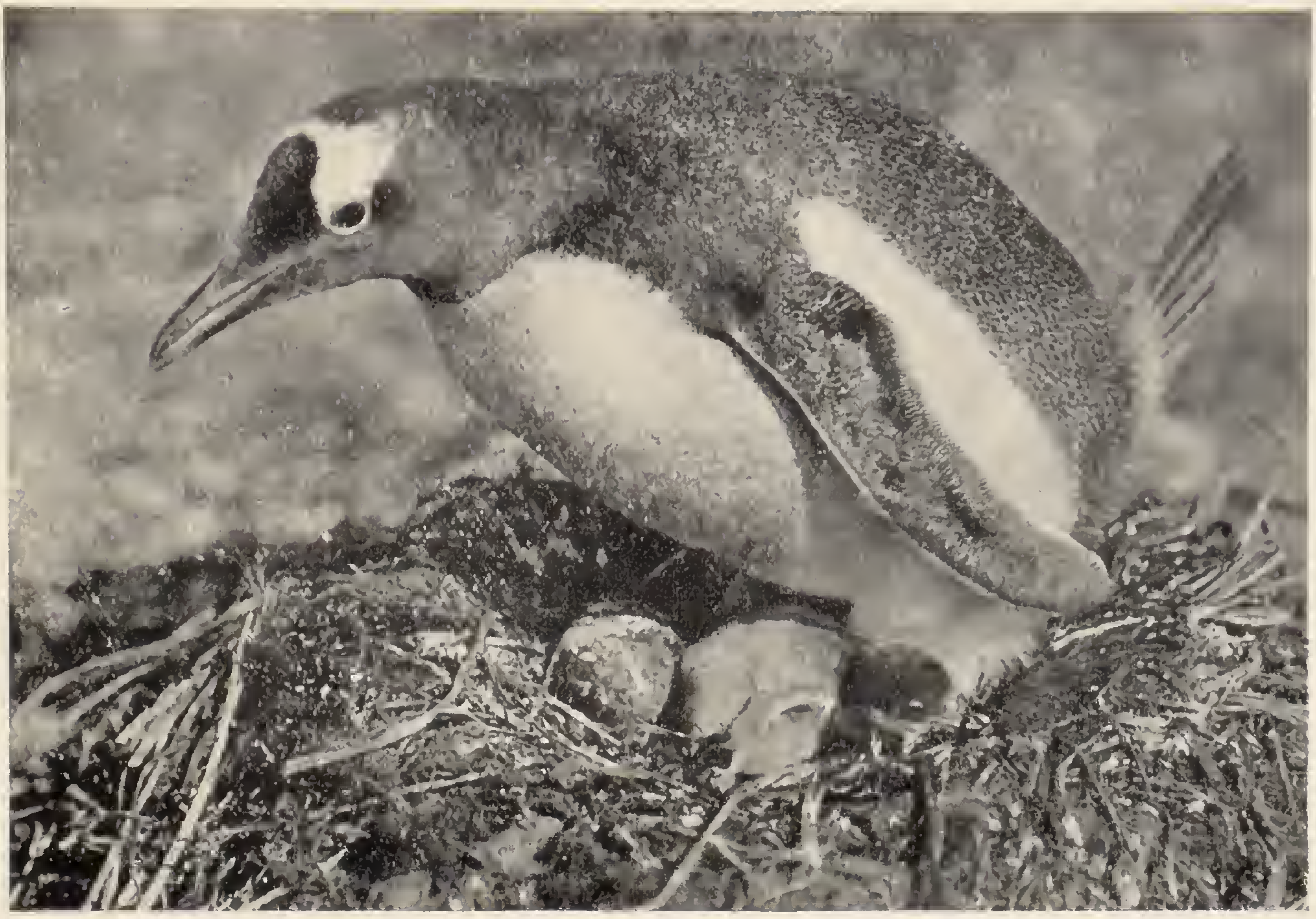
Eudyptes chrysolophus (Brandt).

Catarrhactes chrysolophus Cat. B. Brit. Mus., XXVI, p. 641.

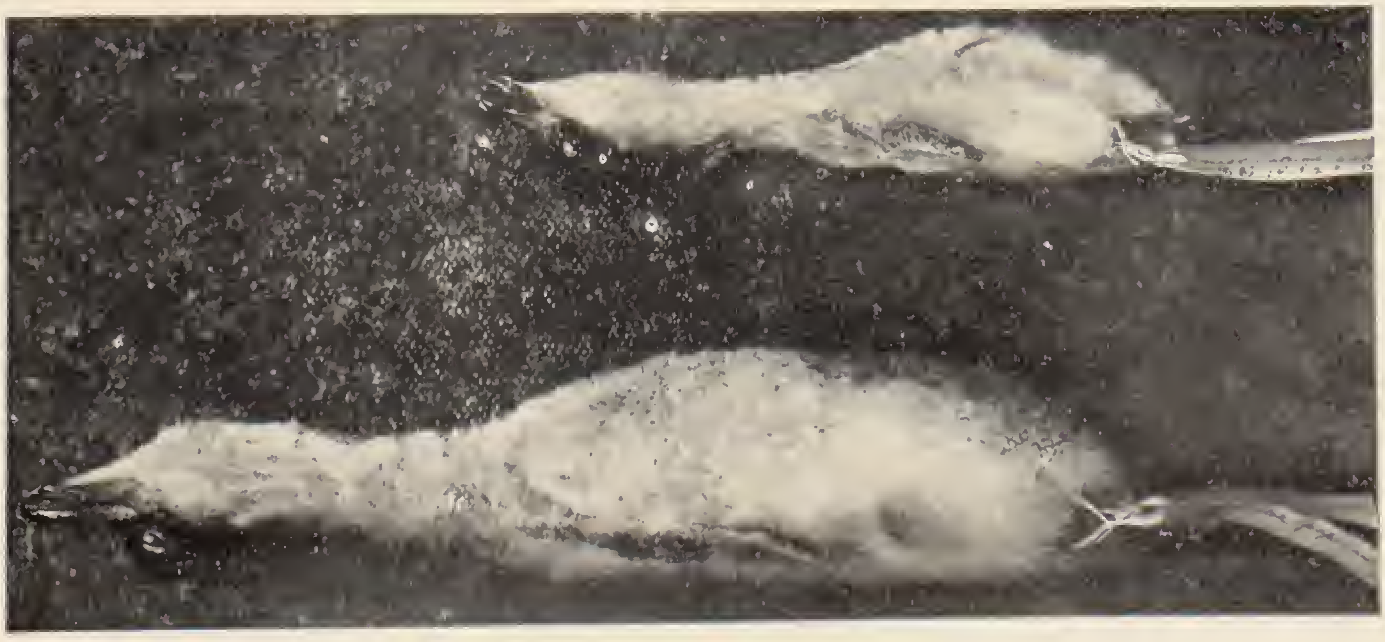
The macaroni penguin was evidently common at the time of Weddell's visit, but the German Expedition of 1882-83 found only a single straying example.

I did not see this species during my stay. That it still exists, however, I was first assured by a letter dated at South Georgia, July 5, 1914, and received by me from Mr. José G. Correia, a New Bedford whaler. From this letter I extract the following paragraph, translated from the Portuguese :

> Captain Larsen asked the commander of the *Undine* to bring four of the penguins which have orange feathers on their heads. These are called maccaronas,



1. Parent with one egg and one newly-hatched young. Bay of Isles, Jan. 10, 1913.



2. Nestmates, collected at the Bay of Isles, Dec. 29, 1912. Discrepancy in size is the rule.

and there are very many of them at the southwest point of the island. I asked him also to bring two for me. When he returned from the trip I went on board, but he had found only four, and these went to Captain Larsen.

Recently, however, Mr. Correia has sent me the skin of an adult female collected at Cape North, near the western end of South Georgia, on February 2, 1915. Its measurements are as follows:

Bill from gape	Exp. culmen	Longest crest plumes	Wing from axilla	Tail	Foot
63	56	72	176	96	112

"Irides red."

Of the two other small species mentioned by Weddell, the "jackass" penguin is obviously *Pygoscelis papua*. The "stone-cracker" is assumed to have been *Endyptes chrysocome*, and is so listed in the British Museum *Catalogue*, p. 636. Von den Steinen (*loc. cit*), however, believes that *Pygoscelis antarctica* is Weddell's stone-cracker, and if this be correct there is no valid record for *Endyptes chrysocome* at South Georgia.*

Spheniscus magellanicus is given in the *Catalogue*, p. 651, as the jackass penguin of Weddell, an interpretation which is certainly erroneous. South Georgia, an essentially Antarctic land, is far without the range of the continental, south temperate, even tropical, genus *Spheniscus*.

APPENDIX.

Confusion and uncertainty have clouded few zoological subjects more thoroughly than the life-history of penguins. Most of the early accounts of these birds were either utterly unreliable, because of the observers' lack of ability to inhibit their imaginations, or else so strangely true as to seem incredible to later, more critical generations.

Since members of the recent Antarctic expeditions have to a great extent worked out and popularized the marvelous social customs, the growth and development, and the life in the sea and on shore, of penguins, the time has passed for tolerating in compilers of ornithological text-books an infinite repetition of other people's errors. As examples of the many untruths and half-truths which occur in recent reference works of pretentious standards, I should like to refer to several of the more conspicuous statements of doubtful worth in the ninth volume of the *Cambridge Natural History*, London, 1909. In this general treatise on "Birds," pages 54 to 59 are devoted to the order Sphenisciformes. From this section I quote the following statements, with comments. The italics, wherever they appear, are mine.

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* *Cf.* Lönnberg *l. c.*, p. 85.

Penguins in general :

Page 55. 1.—"these flippers or paddles have highly compressed bones *with no power of flexure*." Disregarding the absurdity of this clause, I have shown above that its meaning is not true.

2.—"the tongue [is] often rudimentary." No reference is made to the well-developed tongue, highly conspicuous and interesting because of its covering of spines, which is found in many, probably most, species.

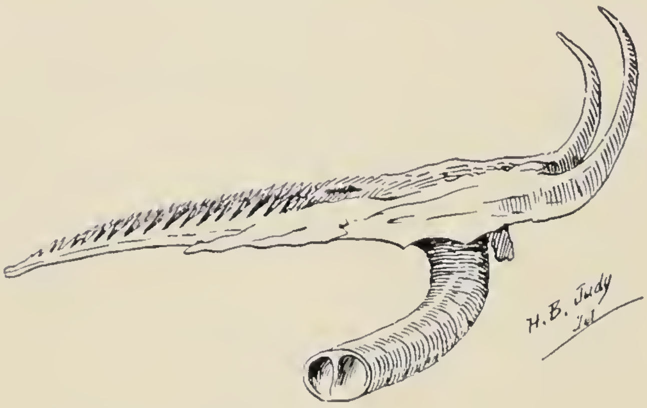
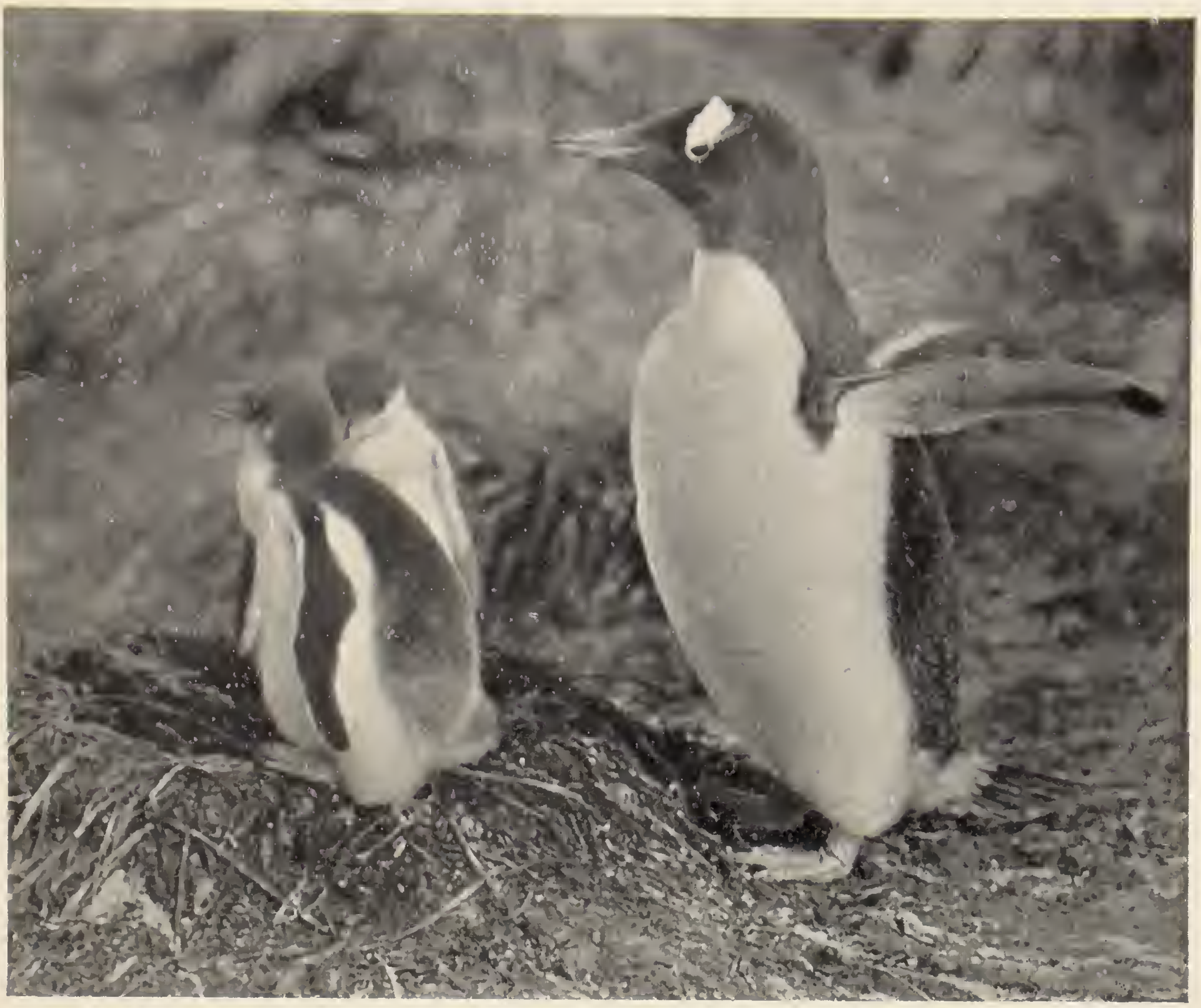


Fig. 4. Tongue and divided trachea of *Pygoscelis papua*.

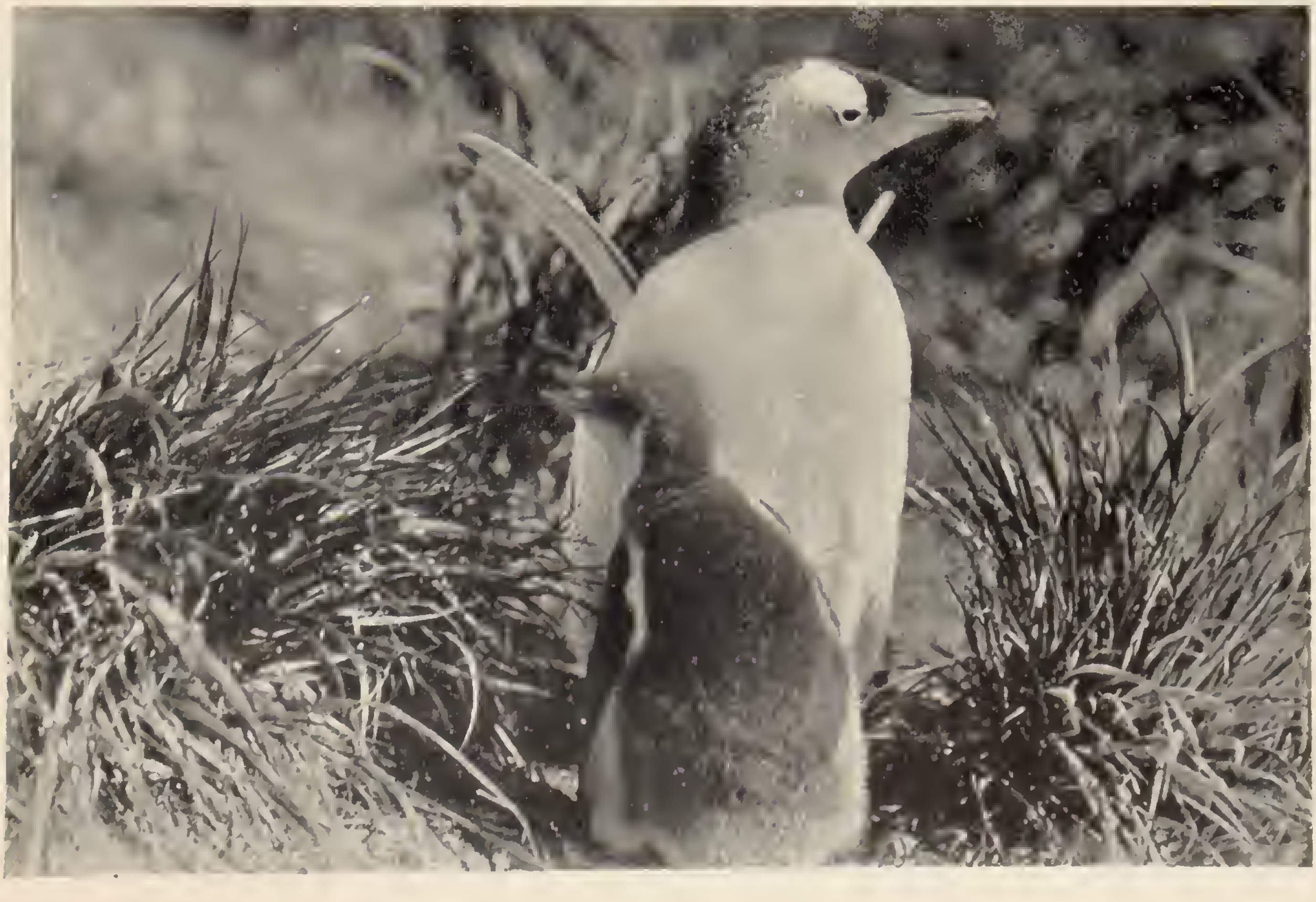
Page 56. 3.—"the two *coarse-flavored* eggs." Penguin eggs number one, two, or three, according to the species. Those of all the Antarctic penguins have been described as delicious eating, or if criticized, it has been upon the ground that they are slightly "insipid." The eggs of the king and johnny penguins have a less pronounced taste than a fresh-laid hen's egg, and consequently require more salt. The one objection to them lies in their appearance, for the albumen does not coagulate readily, and, as von Steinen remarks, a boiled penguin egg resembles a jelly-fish.

4.—"incubation, which lasts about six weeks." For penguins of the genus *Pygoscelis* this period has been determined as from thirty-one to thirty-seven days. The emperor penguin is believed to incubate two months, or thereabouts.

5.—"the parents sit very closely and feed the *blind young* for an exceptionally long period, by *inserting their bill in that of* the nestling." The young of *Pygoscelis papua*, and presumably of its near relations, hatch bright-eyed from the shell. The young of only the *Aptenodytes* penguins are fed as long as those of the wandering albatross, for instance ; and, as for inserting the bill, it is done not by the parent penguins but by the chicks, whose heads disappear within the gullets of the adults.



1. Parent with two half-grown, pot-bellied nestlings. Bay of Isles, Jan. 10, 1913.



2. Parent with one youngster, which has left the nest. The snuggling attitude of this squeaking chick is characteristic.

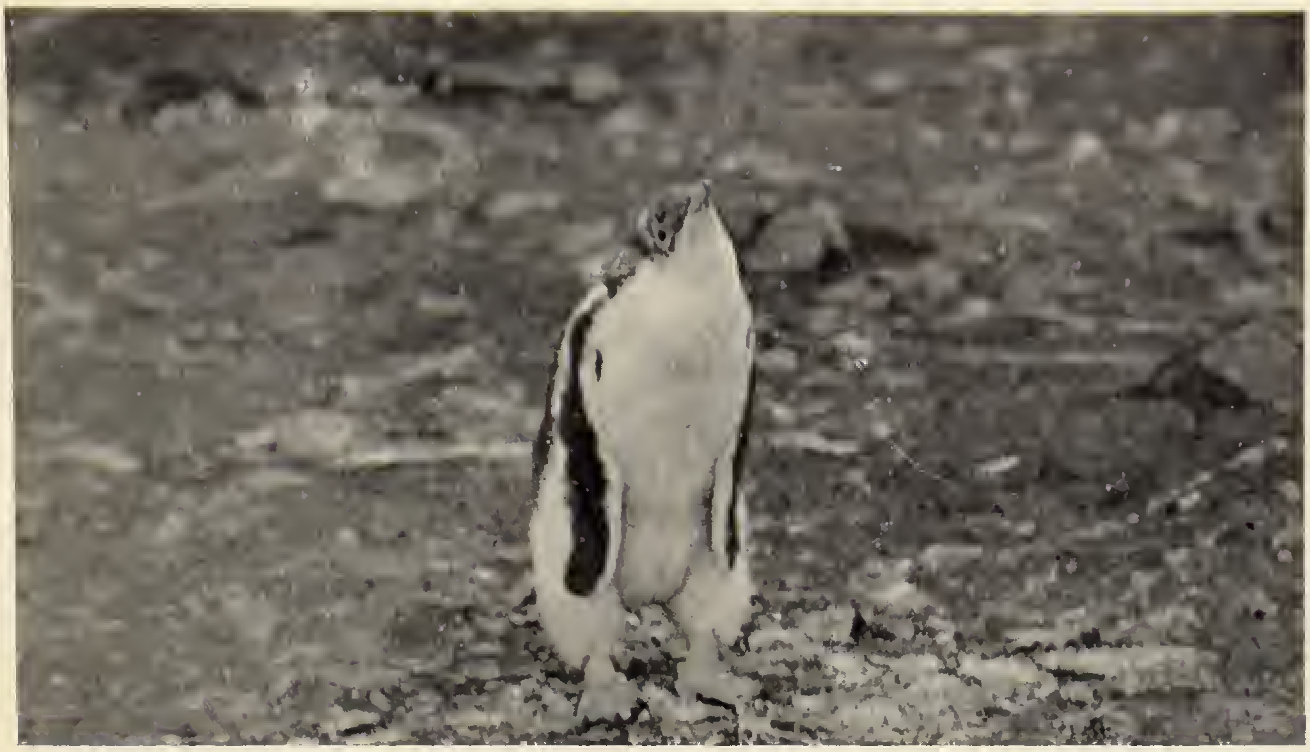
6. "The nestling in down is blackish or yellowish-brown with white lower parts." *Pygoscelis papua* and *P. antarctica* have gray juvenal down. The latter species is pure white when hatched. The young of *Pygoscelis adeliæ*, of *Aptenodytes patachonica*, and others, do not have white lower parts.

Penguins considered specifically:

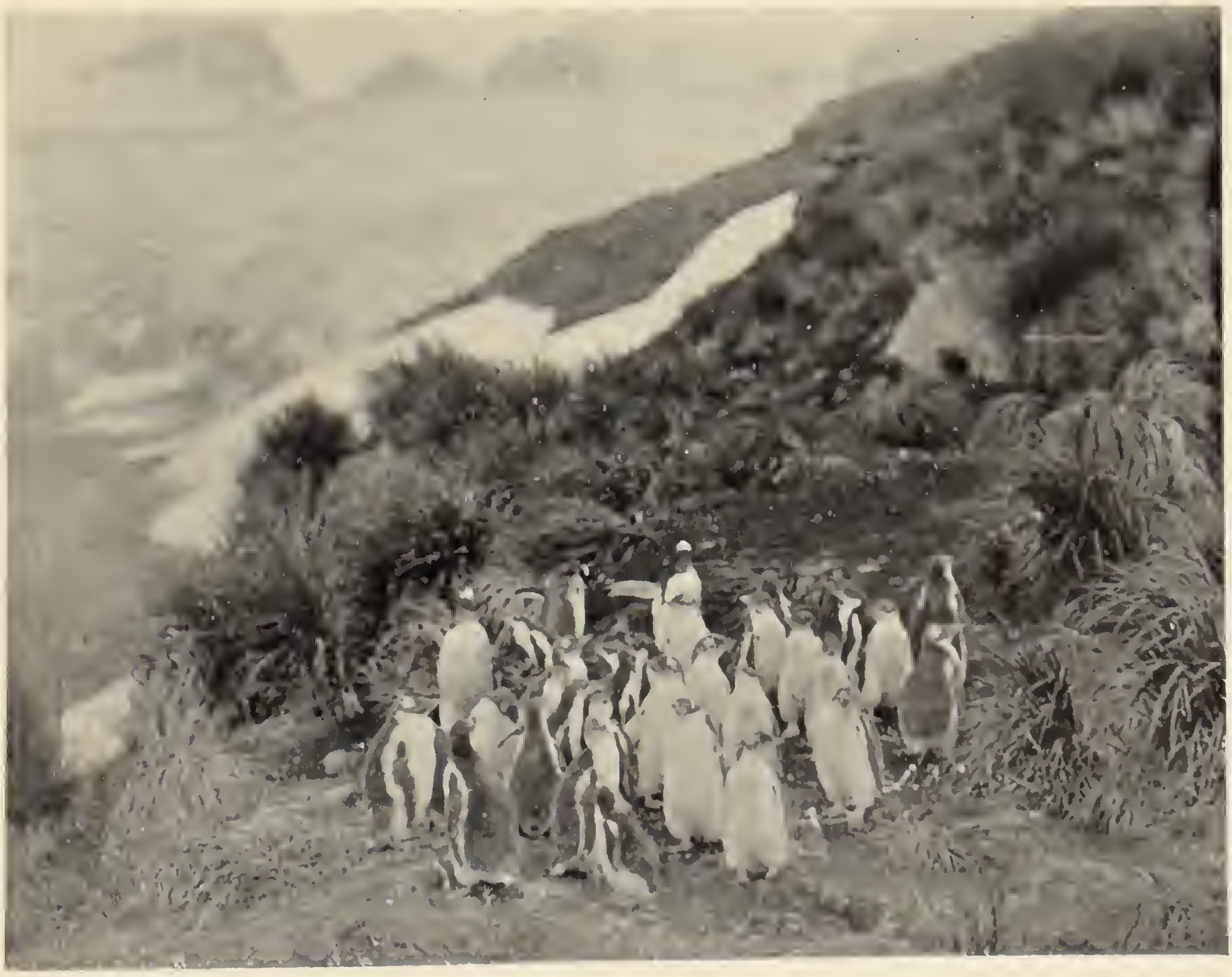
Page 57. 7. The account of the king penguin is misleading in several particulars. Purely incidental notes made by Professsor Moseley regarding this species at Prince Edward Island, are here used as generalities. Among them are the broad statements that the "breeding grounds are flat places of hard soil covered with slime;" that the birds run at a great pace "maintaining an upright position;" and that "they pass to and from the water singly, and not in flocks, as do other species." As long ago as 1834, it was recorded that king penguins at Macquarie Island marched to and from the water in flocks of thirty or forty thousand.

Page 58. 8.—"there seems to be little doubt that the incubating position is at least half upright in the case of penguins generally." *Cf.* photographs of any species of *Pygoscelis*.

Page 59. 9. The rock-hopper penguins "have a most curious habit of stretching out the legs below the tail, *laying their wings flat to their sides*, arching their necks forward, and then making a sudden spring clear out of the waves," Truly a curious habit, for by laying their wings to their sides they must take away their only means of making the spring.

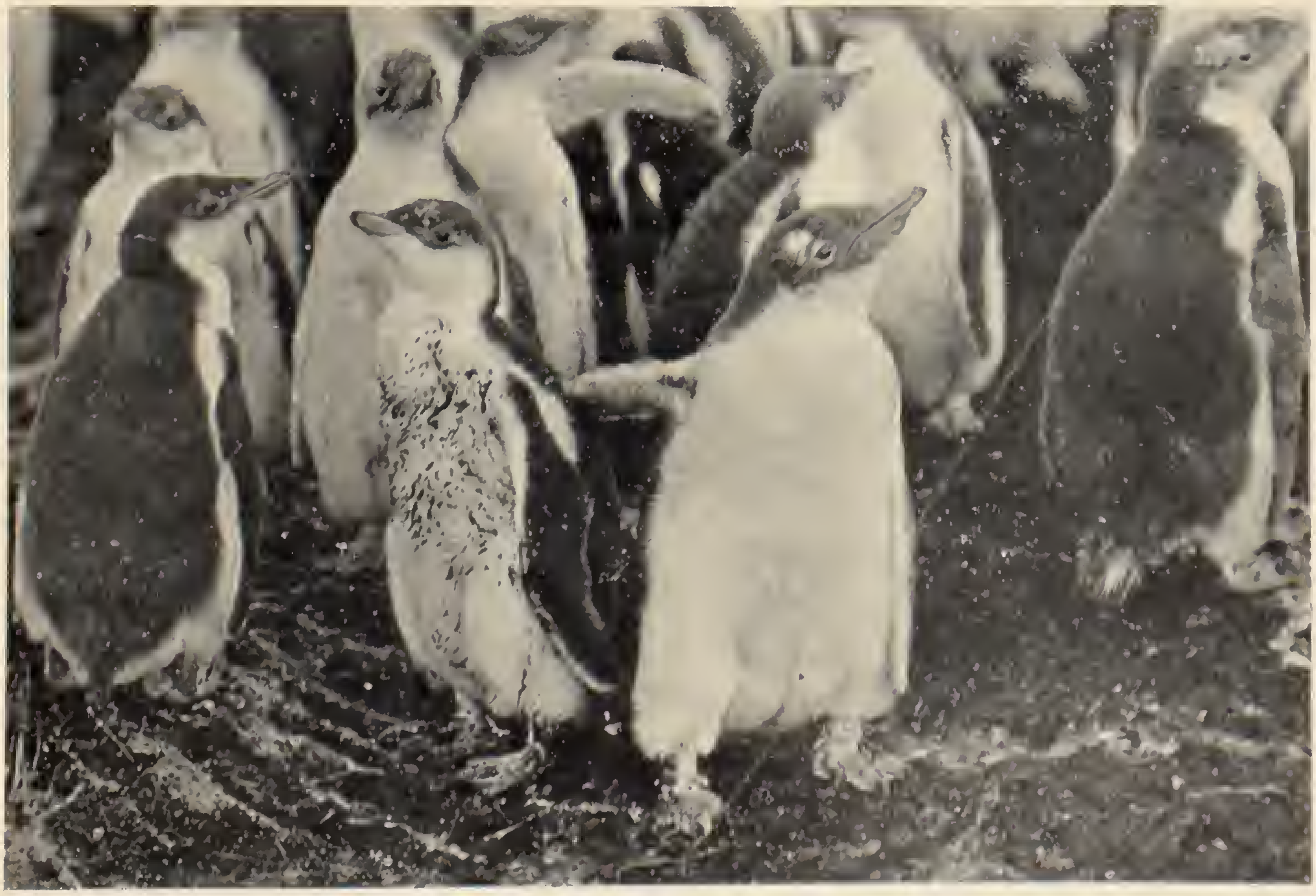


1. Young johnny penguin at the beginning of the post-juvenal molt. Bay of Isles, Feb. 14, 1913.

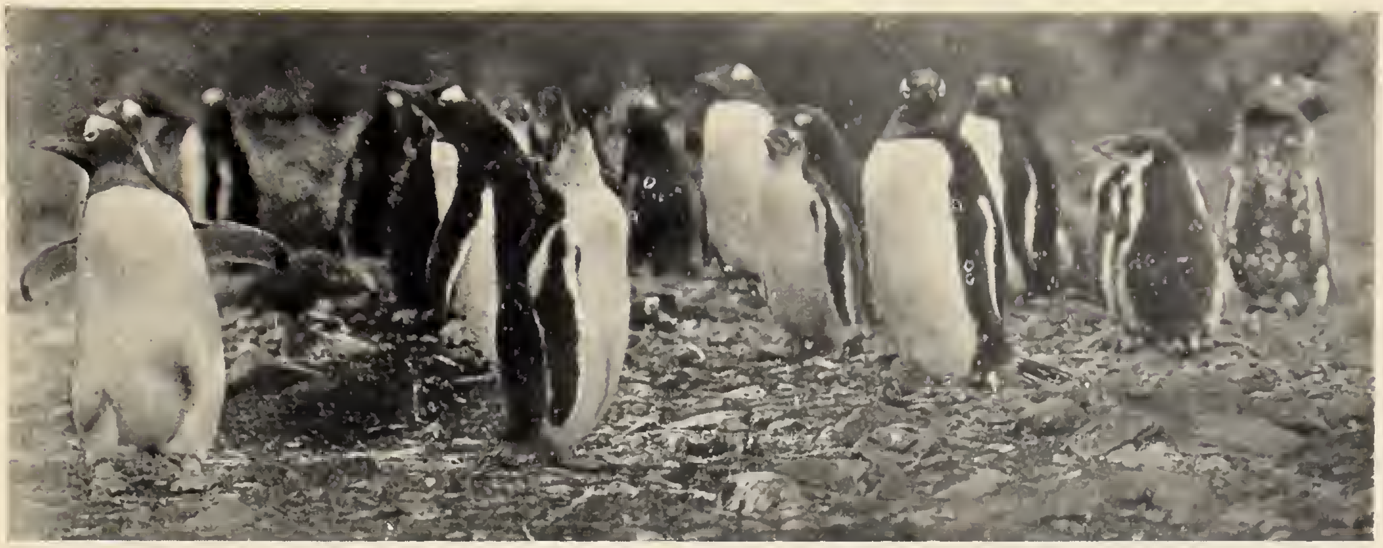


2. Downy young, under guard of adult nurses, on a tussock-grown hillside near Lucas Glacier. Feb. 4, 1913.

1. Three frightened youngsters running at top speed. Feb. 4, 1913.



2. Well-grown young, Feb. 4, 1913. The appearance of the white eye-spot is the signal of the approaching molt of the down.



1. Downy young, adult nurses, and molting adults. Bay of Isles, Feb. 4, 1913. The youngster in the foreground stands in the "ecstatic attitude," and is trumpeting.

2. Johnny penguins swimming at the surface of a fresh water pond. Bay of Isles, Jan. 10, 1913.

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